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AND

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THE BRITISH FOUNDRYMEN'S ASSOCIATION.

A Retrospect.

If the career of our Association from its incipiency to the present time is to be regarded as an accurate indication of its future, then we are indeed to be congratulated.

New readers of the FOUNDRY TRADE JOURNAL will, we believe, be interested by a recapitulation of the causes which had that effect in the birth of this Society.

It was in the correspondence column of the May, 1903, issue of the FOUNDRY TRADE JOURNAL that the idea was first sprung upon the foundry world in the following letter:—

FOUNDRYMEN'S CONVENTION.

To the Editor of the FOUNDRY TRADE JOURNAL.

SIR,—Would not a meeting on lines similar to that of our American friends be an advantage? I think so. And if it be too late to arrange for this summer, how would such a meeting do at the Manchester Exhibition of 1904? Hoping to hear more on this subject,

I remain,
Yours, etc.,
FOUNDRY MANAGER.

A small beginning truly, but by these few words was the good seed planted from which a noble harvest is to be gathered.

The first word spoken gave an impetus to apparently long-pent-up feelings, and for some months letter after letter appeared from interested foundrymen. Our present Secretary (Mr. Finch) entered the lists in the June issue, and kept himself well in front the whole of the time, and, we believe, mainly by his efforts, for he undertook to communicate with interested parties with the view of calling a meeting, the first committee was called at the Cobden Hotel, Birmingham, on April 9, 1904.

At this meeting it was decided to form the now existing Association, and a prospectus was drawn up setting forth the objects of the Association. The members then present, agreed, in the event of failure, to share the cost of printing and posting the prospectus.

Happy to relate, however, within two months of its inauguration, as a result of the wholesale circularising the "trade" had received, no fewer than fifty applications for membership had come to hand.

A further committee meeting was held on June 11th, at the same place, when it was decided to hold an annual convention, the first to be at Manchester, and to commence Tuesday, August 2nd, 1902. There was not much time for making arrangements *re* speakers, chairman, visits to engineering works, etc. However, the energies of our President, Secretary, and one or two members of the committee prevailed, and our first convention, the first of its kind held in this country, was successful, nearly one-half of our members (by this time we numbered about a hundred) being present. A very instructive and enjoyable time was spent, so much so that we believe that few who attended these meetings will resign from the Society.

Our membership has now well passed the one hundred mark, and Dr. Moldenke, the Secretary of the American Foundrymen's Association, tells us that proportionately to the total men employed we have passed them. This is something to be proud of, and at any rate proves that the Britisher is not now the lethargic character he has so long, and perhaps in a measure justly, been considered to be.

FRANCIS W. SHAW.

Mr. F. W. Finch, Secretary of the British Foundrymen's Association, will read a paper before the Bristol and District Employers' Association at the Greyhound Hotel, on Thursday, April 6, 1905, on "Moulding a Cylinder in Loam." Chair to be taken at 7.30 o'clock p.m. Members of the British Foundrymen's Association are cordially invited to attend, and will be admitted by presenting their card of membership.

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A SERIOUS fire recently occurred at the premises of W. Sugg & Company, Limited, in Regency Street, Horseferry Road, Westminster.

HADFIELD'S STEEL FOUNDRY COMPANY, LIMITED, have received an order from the Government for 300 12-in. armour piercing shells.

ELECTRIC MELTING IN CONNECTION WITH IRON AND STEEL.*

BY F. W. HARBORD.

LAST year, as is probably well known to most of the members of this Society, the Canadian Government appointed a Commission to investigate the different thermo-electric processes for the smelting of iron ores and the manufacture of steel at work in Europe. The author acted as metallurgist to that Commission, and was asked by your Council to give a paper embodying the principal results of the investigations. The paper he has the honour of submitting to the Society is in the main a *résumé* of the report of the Commission.

The Commission visited five different works—two in Sweden, two in France, and one in Italy—and saw various types of furnaces in operation, and obtained a good deal of information respecting other processes which had not passed beyond the experimental stage.

Electric smelting furnaces may conveniently be divided into three main classes—(1) The induction furnace; (2) the resistance furnace; and (3) the arc furnace—and all these three are now being employed in the metallurgy of iron and steel.

The first type of furnace is especially adapted for melting, as distinct from smelting—that is to say, for melting down mixtures of different metals to form certain definite alloys, rather than for the reduction of the metals from their ores, although under certain conditions it can be used for the latter purpose. The second type can be used either as a melting or smelting furnace by varying the construction; and the third type, although generally especially designed for the direct smelting of ores, can also be adapted to either purpose. In all cases, whatever the type of furnace employed, the object is to supply the heat necessary for the particular operation by means of electric energy, the latter not being used to assist directly in the chemical reactions, such as reduction or oxidation; in this way the electric energy replaces the coal, coke, or gas used for heating, and it will readily be realised that in countries where fuel is cheap, as it is in England, the circumstances are comparatively few where it can be commercially employed.

For certain purposes, however, where it is important to obtain a finished product of great purity, where intense local heat and a non-oxidising atmosphere are required, electric energy enables us to meet the con-

* A Paper read before the Faraday Society.

ditions more economically than can be done in any other way.

Steel Making.

Under existing conditions, the electric furnace can compete with only two methods of steel manufacture. (1) The crucible steel furnace; (2) the open-hearth or Siemens furnace for the production of high-class carbon and special steels. The crucible steel process, as is well known, consists in selecting the purest materials, and mixing them in such proportion that, when melted in pots or crucibles, they will give a steel containing the required amount of carbon, and the highest qualities are made from selected cemented bars, which latter are made from the best Swedish Walloon iron. In this process practically all the impurities present in the original materials will be found in the finished steel.

The open-hearth, or Siemens, process consists in melting pig-iron and scrap steel in a gas-fired regenerative furnace, and in the gradual elimination of the impurities present by the oxidising action of oxides of iron, and the addition of suitable fluxes to retain these in the slag; during the operation the greater part of the carbon is removed, and the amount required in the finished steel is obtained by adding pig-iron and alloys of manganese containing carbon to the bath of metal towards the end of the operation. The elimination of impurities in the bath of metal is never quite complete, and in addition the metal is liable to pick up certain impurities from the gas burnt in the furnace, and also to absorb or occlude certain proportions of different gases. The result is that although extremely high-class steel can be made in a Siemens furnace, it is not equal to the best crucible steel.

The Induction Furnace.

This type of furnace is a large crucible in which the steel is melted by an induced current out of contact with any electrodes, completely protected from the action of any furnace gases, and practically protected from oxidation. It gives, from a metallurgical point of view, by far the nearest approach to the conditions of the crucible process, and provided the same care is taken in the selection of the raw materials, a finished product, equal in all respects to crucible steel, is obtained. The best known furnace of this type is the Kjellin furnace, which has been in operation at Gysinge, Sweden, since 1900. Fig. 1 is a sectional elevation of this furnace. Figs. 2 and 3 show views of the tapping and charging platforms. This furnace is in effect a step-down transformer, in which the contents in the hearth or crucible form the secondary circuit of the transformer. The furnace is of 225 h.p. capacity, and to the primary is delivered an alternating current of 90 ampères and 3,000 volts, which induces a current in the secondary of 3,000 ampères and 7 volts. When an alternating current is passed through the coil, it excites a magnetic flux in the core, and the intensity of the current induced in the steel is then almost the same as the primary current multiplied by the turns of the wire in the primary coil. The tension of the current is naturally reduced in almost the same ratio as the intensity is increased. In this way it is possible to use an alternating-current generator of high tension, and to obtain a current of low voltage and great intensity in the furnace.

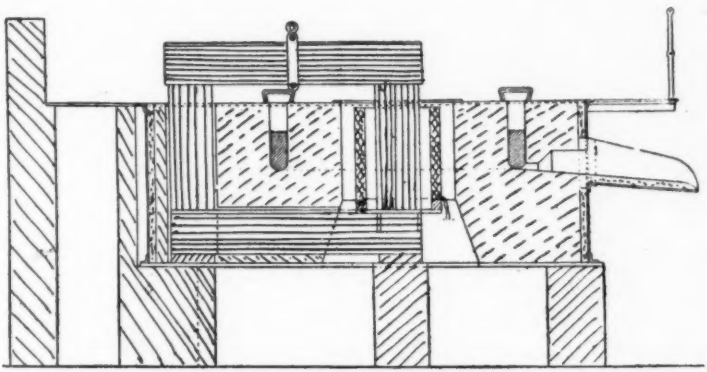

FIG. 1.—KJELLIN'S FURNACE AT GYSINGE.

In starting the furnace, a little molten

pig-iron is poured into the circular trough to form the secondary circuit, and at the finish of each heat, sufficient molten steel is left in the furnace to maintain this circuit. The circular hearth or crucible has movable covers on the top, of a size which can easily be moved by a bar, and the materials are charged in at the top by removing these covers. The charge at Gysinge usually consists of best Swedish pig-iron, Walloon iron, and steel scrap, and the proportions of pig-iron and steel scrap are varied according to the grade of steel it is desired to produce. Any grade of steel can be produced in this furnace, from 0.10 to 1.50 per cent. or more of carbon, the only thing necessary being to have ample power to insure rapid melting, and to obtain a sufficiently high temperature to enable the steel to be cast into ingot moulds.

During the melting there is practically no elimination of impurities, with the exception of a slight oxidation of the carbon, and to obtain a high-class product high-class materials must be used. The charge carefully calculated to give the required content of carbon is charged gradually during the operation as the materials melt down, the pieces of pig and scrap being of any convenient size. When the charge is completely melted, additions of ferro-manganese, ferro-silicon, or other materials which it may be desirable to alloy, are made, and when these are completely melted the charge is held in the furnace for a short time to raise the temperature to a good "tapping heat," when it is tapped in the usual way into a ladle placed under the spout.

FIG. 2.—KJELLIN'S FURNACE AT THE GYSINGE WORKS.

The amount of energy consumed will vary with the grade of steel desired, a high carbon steel requiring less than a low carbon steel, as the former has a lower melting-point, and does not require to be raised to such a high final temperature to enable it to be cast into ingot moulds without "skulling," *i.e.*, partially setting in the ladle. The average time for producing about one ton of steel ingots is

six hours for high carbon steel, and from seven to eight hours for dead soft, or nearly carbonless steel.

The amount of energy consumed per ton of steel was very carefully determined by Mr. Brown, the electrician accompanying the Canadian Commission, by following various charges through, and taking readings regularly at short intervals during the working of the charge. The following, taken from Mr. Brown's report, gives particulars of the instruments used, and the final results obtained in two charges:—

	Steel 1.082% carbon.	Steel 0.417 % carbon.
Length of run in hours... ...	6	6¾
Mean kilovolt-ampères	217.3	232
Total kilovolt ampère hours...	1304.	1,546
Mean kilowatts	142.8	149
Total kilowatt-hours	857	994
Mean h.p.	195	203
Total h.p.-hours	1,165	1.350
Total h.p.-years	0.133	0 154
Output of ingots, kilos	1,030	955
H.p.-year per ton of ingots (2,240 lbs.)	0.13	0 16
Cost of electric energy at 41/8 per h.p.-year	5.5	6 8
The mean total factor for the run	0.672	0.649

It will be noticed that the energy required for the .417 carbon steel was somewhat greater than for the 1.00 per cent. carbon, which is what would be anticipated, and was confirmed by the other charges when making lower carbon steel.

Although this furnace is more particularly adapted for "crucible" metal melting, it can be, and has been, used for smelting the ore direct, and since my visit to Gysinge further experiments in this direction have been attended with considerable success.

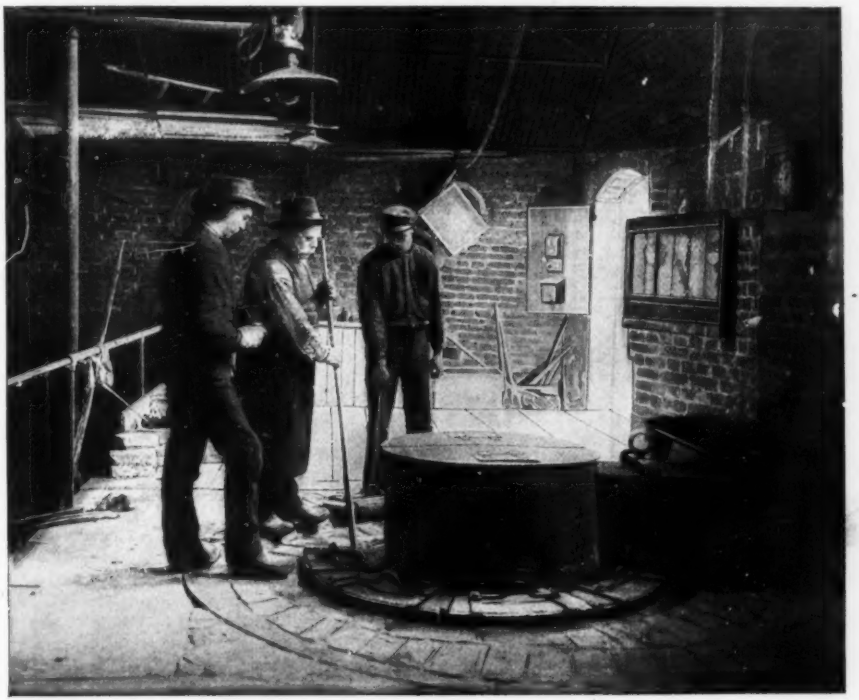

FIG. 3.—KJELLIN'S FURNACE AT THE GYSINGE WORKS.

Mr. Kjellin has sent me particulars of recent developments in a letter dated January 7, 1905, which is as follows:—

"Having at last got a new turbine, we are able to increase the power at the furnace to 175 kilowatts (239 electric h.p.) instead of the maximum being 165, and this increase of power, together with a diminished area of contact between steel, masonry, and slag, has increased the output of the furnace from 4 tons to from 5.2 to 5.5 tons in twenty-four hours, which naturally makes the melting costs lower.

Another reason for these good results is that, owing to some slight alterations, I have got the power applied more uniformly over the whole time of the charge. In future I shall be able to build the furnaces so that they shall consume the maximum power of the turbine or engine all the time. I have already done so in the case of a small trial-furnace, put up last summer in the South of France. The capacity of the Gysinge furnace with 175 kilowatts is now 1,450 kilogrammes, of which 900 kilogrammes are tapped each time. I have recently used pig and ore instead of pig and scrap, and this seems to answer very well. The ore used is briquettes from Herrang concentrates, containing about 70 per cent. of iron, and consequently practically no gangue, so that the wear and tear is not increased to such an extent as would be the case if the ore contained much gangue. The briquettes being very low in phosphorus, I can in this way get a high quality steel cheaper than by using scrap and pig, though the production of the furnace is only 60 to 65 per cent. of the production from cold scrap and pig. If using molten pig and ore I should get the same output from a given power as from cold pig and scrap, but the waste would be much lower, as the iron of the ore would be almost perfectly reduced."

It will be seen from the above that pig and ore can be used in the furnace, but to obtain a high-class product none but extremely pure materials can be employed, and at present Swedish materials are probably the only suitable ones which are available. This furnace in its present form can only be used for the manufacture of tools and other high-class steels, and in the majority of cases, at all events outside Sweden, it will probably pay better to use pig and scrap only, as the saving effected by ore and pig when the reduced output is considered, cannot be very great.

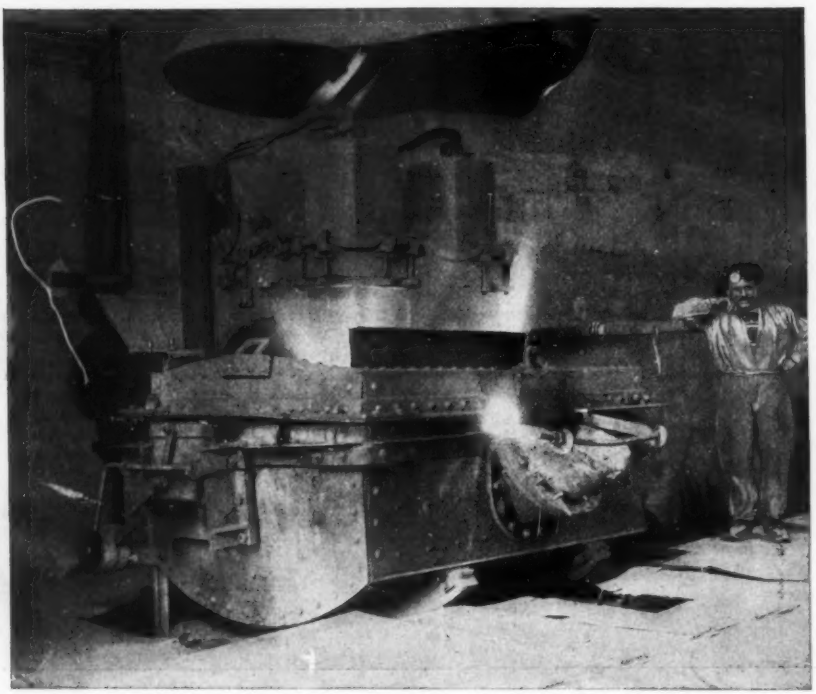

FIG. 4.—400-H.P HEROULT FURNACE AT LA PRAZ.

The Resistance Furnace.

In this type of furnace the heat is generated by the resistance offered by the whole, or a portion, of the furnace charge

to a very powerful electric current. It is best represented by the Hèroult and Keller furnaces, which are both employed commercially in the manufacture of steel and alloys of iron.

The Heroult Process.

The Hèroult furnace for the manufacture of steel has been in successful operation now for several years. One 4-ton furnace at Kortfors, in Sweden, and a somewhat smaller furnace at La Praz, in the South of France, are producing steel commercially on a considerable scale, and of the highest quality. The furnace shown in Figs. 4, 5, and 6 is a tilting furnace, so far as the construction of the body of the furnace is concerned, very similar to that of the well-known Wellman and Campbell tilting furnace. The furnace hearth is basic lined, as in the ordinary basic open-hearth process, and two large electrodes pass vertically through the roof, and can be raised or lowered either by hand or automatically by a specially constructed regulator. An alternating current of 4,000 ampères and 110 volts is used at La Praz, and the intensity of the current passing through the bath is regulated by increasing or decreasing the width of the air-gap between the electrodes and the slag line. The section of the roof between the electrodes is usually made of bronze in order that no magnetic circuit may surround them. The electrodes may or may not be water-jacketed where they pass through the roof, but water-cooling not only increases the life of the furnace and electrodes, but enables a considerably larger output to be obtained. At the date of my visit the Kortfors furnace had water-jacketed electrodes, while the La Praz furnace had not, but the latter has since been provided with these.

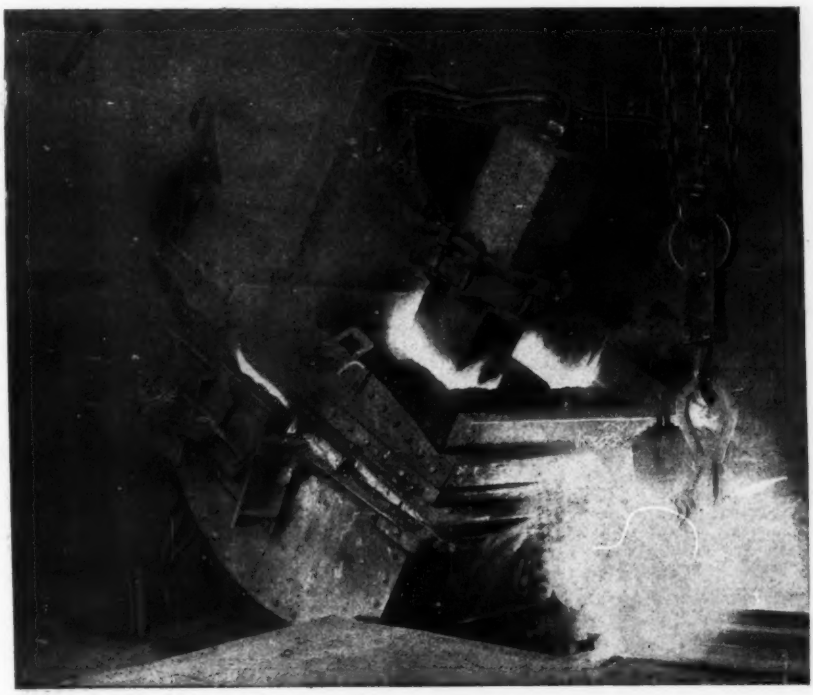

FIG. 5.—400-H.P. HEROULT FURNACE AT LA PRAZ.

One very great advantage connected with this furnace is that common steel scrap of good average quality, such as bar ends, rail ends, etc., can be converted into steel of the highest quality, and it is not necessary to use an exceptionally pure or high-priced material, as in the

induction furnace. The construction of the furnace is such that it enables the impurities in the scrap iron to be readily removed by the addition of suitable fluxes, and the slag can be poured off, and a new slag made at will to further remove any remaining impurities.

The furnace is charged by throwing the scrap iron or steel on to the hearth of the furnace through the doors at the end, and the electrodes are then lowered sufficiently to establish the electric current, the current passing through the pieces. Gradually, however, the entire charge melts, an arc is established between each electrode, and the molten iron and the two arcs absorb the greater part of the energy. The position of each electrode is controlled by an automatic regulator by means of a small motor at the back of the furnace geared to the mechanism supporting the electrode. An electric mechanism actuated by variations of the voltage below or above certain predetermined limits controls the motor, which, according to the direction of its

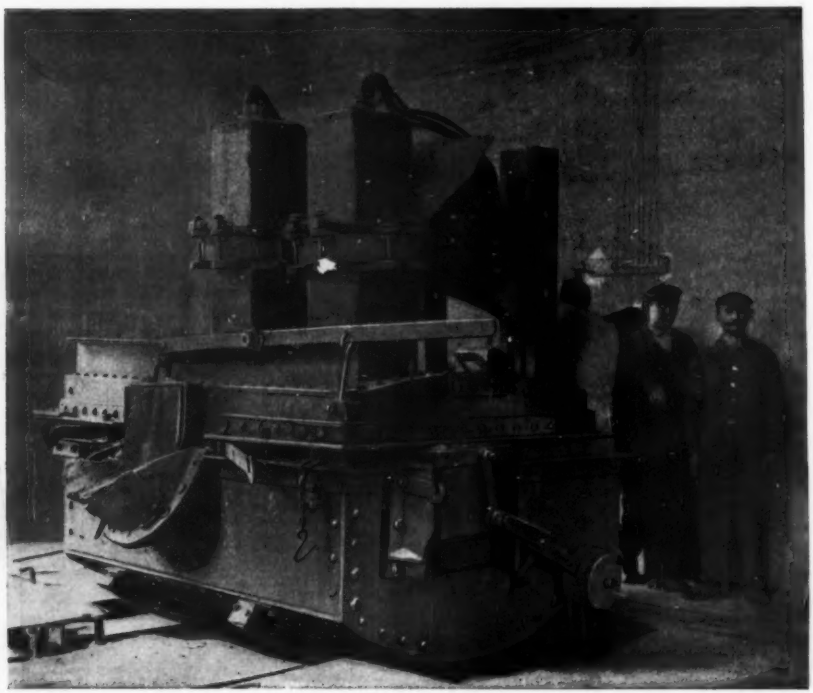

FIG. 6.—400-H.P. HEROULT FURNACE AT LA PRAZ.

charge from one electrode to the other. In the early stages of the heat, when the charge is melting down, the electrodes are generally in contact with some parts of it, and the energy is largely absorbed by the numerous high-resistance contacts and small arcs between the pieces forming the charge. During this period there are great variations in the resistance of the hearth, and violent fluctuations of the current, due to the continual change in contacts and disruption of the circuits owing to the melting of the different rotation, raises or lowers the electrode. During the melting stage, or when pouring off the slag, the arc is liable to be short-circuited, and it is better then to switch out the regulator and regulate by hand.

The method of working is as follows:—Miscellaneous scrap, with some lime, is charged on the furnace hearth, and as the charge melts, further additions of scrap and lime are made, a little pure iron ore being added when the metal is entirely melted. After the bath has been

molten for some time the furnace is tilted, the slag poured off, and, finally, raked off the surface, until practically nothing but metal remains in the furnace. A new slag is now formed by suitable additions

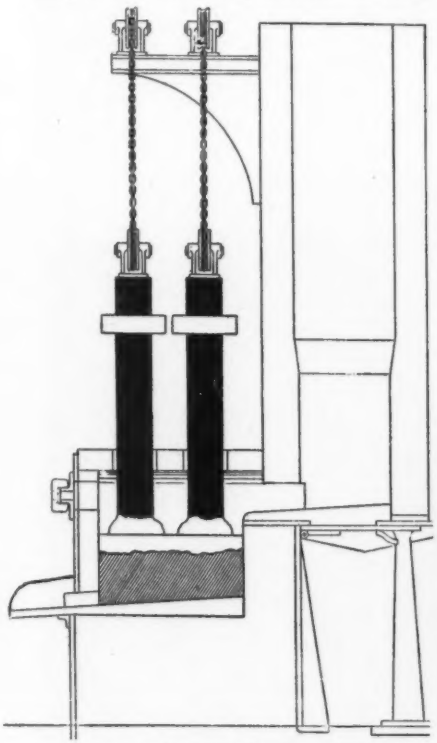

FIG. 7.—KELLER'S ELECTRIC REFINING HEARTH.

or ore and lime; this is melted and kept in the furnace for some time, when it is removed in the same way as the first slag, and a third slag formed to remove the last traces of impurity. Ferro-manganese in the case of low carbon steels is now added, and the metal is ready for pouring into the ladle and teeming into the ingot mould. When high carbon steel is required at the end of the operation, "carburite," a mixture of pure iron and carbon, is added in the furnace in such a quantity as to give the percentage of carbon required in the finished steel. During my visit to La Praz, steel varying from .079 to 1.000 per cent. was made without the slightest difficulty, the former being a special low carbon steel used for transformers.

The following, taken from the Canadian Report, gives some particulars (the charges given are for a low carbon and a high carbon steel). The usual charge was about three tons, but the low carbon heat was a very small one, as only a small quantity of this steel was required for a special order :—

	Dead soft steel.	Tool steel.
Length of run, total hours ...	4½	8
Mean voltage	108	110
Mean kilowatts, partial gate opening	210	215
Total kilowatt-hours	1,410	2,580
Mean h.p., full gate opening...	480	462
Total h.p -hours	1,920	3,500
Output of ingots, kgs.	1,283	2,341
H.p.-years per ton of ingots (2,240 lbs.)	0.17	0.17
Cost of electric energy per ton of ingot, at £1-8 per h.p.-year	7/1	7/1

In the above figures of energy consumed the short periods have been neglected during which the current was taken off to remove the slag. The violent fluctuations of the current and the liability to short circuit make it desirable to limit the possible current to a moderate over-

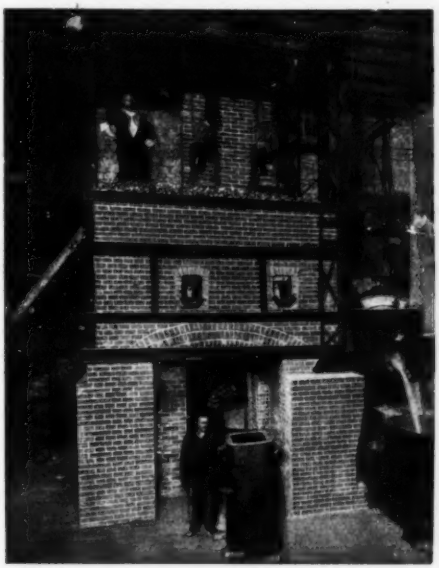

FIG. 8.—KELLER'S DOUBLE FURNACE AT KELLER, LELEUX, & CO.'S WORKS, KERROUSE, FRANCE.

load by the use of a suitably designed alternator and transformer.

It will be noted that the energy consumed per ton of ingot produced was the same in the low carbon steel as in the

high carbon steel, but this is due largely to the smallness of the charge in the former case, and had it been a full heat, the energy consumed would have been considerably less.

The Keller Steel Process.

At Livet, at the works of Messrs. Keller, Leleux & Company, the process of steel-making is not carried on commercially, the chief business of this firm being the manufacture of alloys. They have, however, an experimental furnace of about 35 cwt. capacity, in which they made an experimental heat. The furnace employed was identical, from a metallurgical and an electrical point of view, with the Hèroult furnace, differing only in details as to tilting, etc. The electrodes passed through the roof, an alternating current was employed; common scrap was the raw material, and purification was effected by removing and renewing the slag several times. The charge made was of medium carbon, and the energy consumed was about .120 e.h.p. years per ton of ingots made. Before considering arc furnaces it may be desirable to compare the three processes of steel-making above described, which will be done in another article.

(*To be continued.*)

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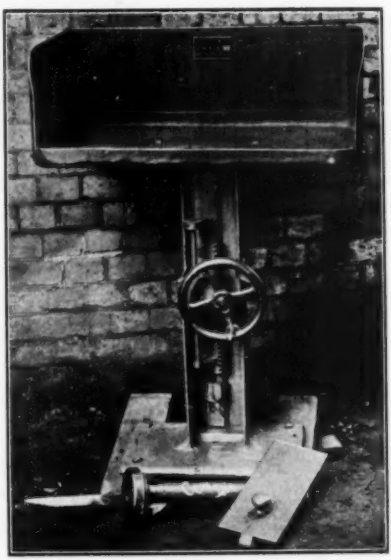
Repairing Cracks in Castings.—A useful method of repairing cracks in castings, such as locomotive cylinders, is described by a correspondent of the "American Engineer." Where a crack is to be drawn together the ordinary method is to bolt forgings with projecting ears on each side of the crack and through these ears put bolts for drawing the adjacent sides together. This makes a clumsy looking job, and in some cases it is difficult to get the necessary strength in the repair to hold the parts firmly in place. The alternative method referred to by the correspondent is as follows:—A piece of iron, 1¼ in. thick, was turned to about 8 in. in diameter and then cut through the centre, making two semi-circular pieces. These were fastened by ¾-in. patch bolts on either side of the crack in such a position that their contours would form a circle. The cut through the centre represents about the allowance for drawing the crack together. A heavy band of iron was then shrunk on the pieces, drawing the crack tightly together and making a steam-tight joint. This method of cylinder repair does not interfere with the jacket, as the lagging can be fitted around it, making the top of the plate flush.

RICHES' CORE-MAKING MACHINE.

The annexed illustration shows a core-making machine, made by Riches & Company, of Beccles. This machine is of very simple construction. The main part is cast in one piece, and the top part is bored and faced to receive the core-boxes, which are machined to suit interchangeably. These are placed in and secured by giving a quarter turn. A crosshead and rack carrying the piston-rod slides on a guide-bar fixed inside the box-frame or standard. This rack is actuated by a

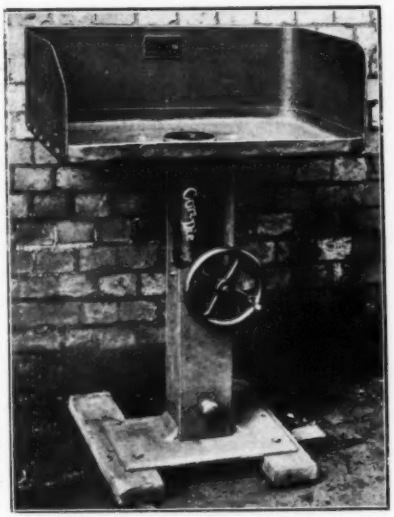


Machine open for changing.

pinion and handwheel when ejecting the cores. On the guide-bar is fixed a rule, and by setting the adjustable stop on this guide-bar to any length, say 6 inches, then the cores are made 6 inches long, or whatever length is required up to 12 inches in the size A machine, and of any diameter up to 3½ in., according to the size of the core-box in use. The machine can be set to any size and length within its range in less than one minute. A vent pin is fixed in the machine which makes it certain that all cores made have a vent through.

A table, 2 ft. 6 in. by 1 ft. 9 in., is provided for sand and tools, and the top of the core-box comes about 1 in. above the table surface, so that the core sand

can easily be worked in by one hand, while the pegger is used by the other hand. A large quantity of accurately shaped cores can be made in a day (60 to 80 cores, 2 in. diameter and 6 in. long, can be made by a lad per hour), and when making small cores by a multiple core-box, hundreds are made per hour. No special mixture of core sand is required with this machine, and round, square, shouldered or necked cores are all easily made. The machines are made in two sizes. Size A for making cores up to $3\frac{1}{4}$ in. diameter by 12 in. long, and size B for making cores up to 6 in. diameter by 15 in. long.



MACHINE READY FOR USE.

For occasional jobs either machine can have an attachment for making cores up to 9 in. and 12 in. diameter respectively, or multiple core does can be fitted to either size, as required.

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MESSRS. YEADON, SON & COMPANY, of Leeds, have arranged for Henry Berry & Company, Limited, of that city, to be the sole makers of their briquette machinery.

S. OSBORN & COMPANY, LIMITED, Clyde Steel and Iron Works, Sheffield, have appointed Mr. W. N. Gill to assist their representative in Scotland — Mr. W. McKinnel.

THE NORTH-EASTERN STEEL COMPANY, LIMITED, have placed an order with Mr. E. F. Jarvis, of Middlesbrough, for one of his patent open-type "British" water-cooling towers.

SCIENCE IN THE IRON FOUNDRY.*

BY J. E. STEAD, F.R.S., F.I.C., etc., Middlesbrough.

BY the term science, as applied to the iron foundry, is meant the exact knowledge of things relating thereto which has been proved by demonstration. During the last 30 or 40 years metallurgists have been steadily advancing in knowledge as to what is right and wrong in the fundamental principles, particularly in connection with the metallurgy of steel. It is unfortunately a fact, however, that, until within recent times, the iron foundry has not received the attention which it deserves; there is, however, a good deal of information regarding the correlation of chemical analysis and mechanical properties of cast iron to be found in many publications both in Europe and in America.

Although science in the foundry may be said to embrace all the facts relating to foundry practice, it is not my intention in this paper to dwell upon more than the effect of metals and metalloids on cast iron, leaving the consideration of the effect of varying casting temperatures and other matters for future communications.

There is much to be said in favour of the old-fashioned method of mixing metals employed in the more carefully conducted works, in which a large number of brands and qualities of iron are kept in stock, and are mixed in the proportion which long and painstaking observation of the foreman foundryman has proved in practice to give the very best results in each class of castings. Indeed, it is the castings made by this method to which analysts were obliged to go in order to ascertain what was the best chemical composition, and thus to obtain their standards.

The object of writing this paper is to direct the attention of founders and others to certain necessary and fundamental conditions for carrying out foundry practice to-day, and to suggest a few definite lines which metallurgical chemists in foundries should follow in order that their services may have the maximum value to both themselves and their employers.

Arrangement of Stock in the Stock Yard.

Those who prefer to work on what may be called the hand-to-mouth principle can have little or no use for a chemist, and cannot possibly make the best of progress,

* Abstract of Paper read before the Cleveland Institution of Engineers.

for they are completely at the mercy of the sender of the pig-iron, who, if he supplies foundry iron of the grades specified, may send material with greatly varying properties.

Many works are so arranged that it is impossible to keep stocks, and they have no alternative but to feed their cupolas direct from the trucks or from the 20 or 30 tons of metal they have room to stock.

Their remedy is to demand an analysis from the maker of each brand, and accept only such iron as contains the specified quantity of silicon, etc. It has been the practice of hematite pig makers to test each cast and to stock according to the analysis, and there should be no difficulty in doing the same thing at furnaces making foundry iron.

Many furnaces in the future are likely to be driven much more rapidly than is the practice to-day, and as rapid blowing tends to the production of iron low in silicon, if such iron be sent out indiscriminately with the same class of iron made in the more slowly driven furnaces, the result will be chaos in the foundry.

Up to the present foundry pig has been stacked, when put into stock for warrants or other purposes, solely according to the grade of the fracture and not to analysis. I maintain that the time has come when this old-time custom must be swept away, and it is the buyers of foundry iron only who have the power to effect the change, for by demanding chemical composition as well as fracture numbers the makers will be obliged to meet them, but certainly cannot be expected to do so if it is not asked for.

When ordering pig metal it is very important that the analysis be demanded, and also, where possible, that each day's delivery shall be taken from a single cast of iron, or if more than a single cast is sent in any one delivery, to have the trucks ticketed, so as to show the cast and analysis.

The stock yard should be arranged in such a way that there is easy access from the cupola to the stacks of pig, and equally easy access from the railway sidings. Where many brands are used, the area required will necessarily be greater than when a small number are stocked. The arrangement of the stacks must depend upon the space available and the work done. The system I should prefer is to make long rectangular narrow stacks, say, 20 ft. to 30 ft. in length, 5 ft. in width and 5 ft. in height. These should run parallel with the railway. In unloading the iron from two or three trucks at a time, the pigs should be spread equally over the 25 ft. by 5 ft. area, and this system should be continued when laying down the iron from sets or other trucks of the same brand, until the height of the stack of 5 ft. is reached. Samples having been taken, these should be sent to the laboratory for testing purposes, and no iron should be used from any stack until its average composition is known. In taking metal from them to melt in the cupola, what is removed should represent an average of every layer. This is done by working from one end of the rectangular heaps to the other.

When the first stacks are being worked up, duplicate stacks should be made, preferably opposite those of like brand, on the other side of the tram or railway.

The scrap iron should be stocked according to its fracture, and average analyses be made of the stacks laid down. Two separate stacks should be sufficient, one of good grey heavy scrap, and one for small rusty material.

Sampling Pig-Iron for Analysis.

When a consignment of pig-iron arrives at the works, before taking any sample note should be made whether or not the metal in the trucks is apparently regular or of mixed quality. If regular, two or three pigs off each truck should be selected. If irregular a larger number. These should be broken and note taken of their fracture number. Drillings should be taken from the side, half way between the bottom and top of the pigs. After the drill has penetrated one-eighth of an inch below the skin what is removed in this way should be rejected and the drill then bored to the centre, and the clean drillings reserved for analysis. The drillings from the several pigs should be mixed in equal proportion, and the mixed sample be thoroughly cleansed with a magnet to eliminate any grains of sand which may have accidentally fallen into it.

The importance of taking drillings from the position given will be recognised when it is known that the sulphur is always much higher at the top than at the bottom of the pigs. Indeed, I have found three or four times as much in the upper layer as was present in the bottom layer. Guy Johnson, in one of his trials, found an average of 0.024 per cent. in the lower part, 0.108 per cent. in the central portion, and 0.148 per cent. in the upper layer, the centre portion approximating to the average. The more manganese present in the pig the greater is the flotation of the sulphide of manganese to the top.

It will be readily conceived that in consequence of the property of the sulphur

compound to float off, the metal which runs into the pig moulds should have less sulphur than the same material when it leaves the furnace. This is actually the case, and the difference is usually the greater when the amount of manganese present is larger. I have met with scum on the surface of basic pig which contained 5 per cent. sulphur.

The American Association for the standardisation of methods of testing suggest taking four pigs from every car and boring with a large drill each fractured end at a point midway between the centre and the side. This method has the advantage that there is less liability of sand getting into the sample, and there is less trouble in drilling. Both methods should give the same average sample.

Practical Suggestions.

To those who wish for the introduction of scientific methods into their foundries, the following points should be remembered:—

1. An analyst who has no metallurgical knowledge is only useful for supplying true analyses, but in that respect he is indispensable.

2. Foundries rarely have fully trained metallurgists to control the mixing and casting of metals.

3. If there is a metallurgist in the foundry he will be able to usefully apply the analyses provided by the analyst.

4. The primary essential is to have accurate analyses, and in making a selection a chemist should be chosen who has had a metallurgical training in a technical college, or a full course of City and Guilds, or other equally good series of lectures on the metallurgy of iron and steel, or who, by private study, has fully qualified himself.

5. It is a rare thing to find a chemist who has had a practical experience in a foundry, and the founder must take the material available.

6. Having selected a man, his real training must begin on entering the foundry laboratory, and whether or not he develops into a useful metallurgist must largely depend upon his ability and capacity for gaining knowledge.

7. To facilitate this his employers should provide him with every standard metallurgical treatise containing useful data on foundry practice, a complete set of the journals of the Iron and Steel Institute and kindred Institutions, the FOUNDRY TRADE JOURNAL, "The Iron and Coal Trades Review," "Engineer," "Engineering," other English technical papers, also "The Iron and Steel Metallurgist," edited by Mr. Sauveur, Boston, U.S.A., and in order that he may obtain the Transactions of the American Foundrymen's Association, he should become a member of that Institution. He should also be supplied with the valuable index, viz., "The Engineering Press Monthly Index Review," and whenever any paper of value on foundry practice is published it should be obtained. The index referred to will enable him to find out where and how he can obtain them. If there is objection on account of the cost of this course, efforts should be made that books and papers become available at the nearest free library.

8. One of his duties should be to read everything published on foundry work, and to ensure that he does this he should supply periodically to the head or principal a review of the publications.

9. He should ascertain the best chemical composition for any particular class of work, and castings which have given maximum good service should be obtained and analysed. All castings which have gained a high reputation should be tested, and portions of castings which have failed should likewise be analysed. In this way real knowledge will be obtained, and a solid foundation laid, for he will know what to aim at and what to avoid.

10. It may be accepted as a general rule that the value of any average brand depends upon its composition, that is to say, if a mixture of several brands has the same composition as that of any other brand, the metal will have the mechanical properties of that brand. For instance, it is easy to make a mixture from irons in this district which will have all the good properties of any of the Scotch brands.

11. If the output of a foundry does not justify the employment of a metallurgical analyst, the makers of pig-iron should be asked to provide analyses with each delivery to an approximate specification, and if an extra price is demanded for this, say, sixpence to a shilling per ton, it should be paid; they will be worth it.

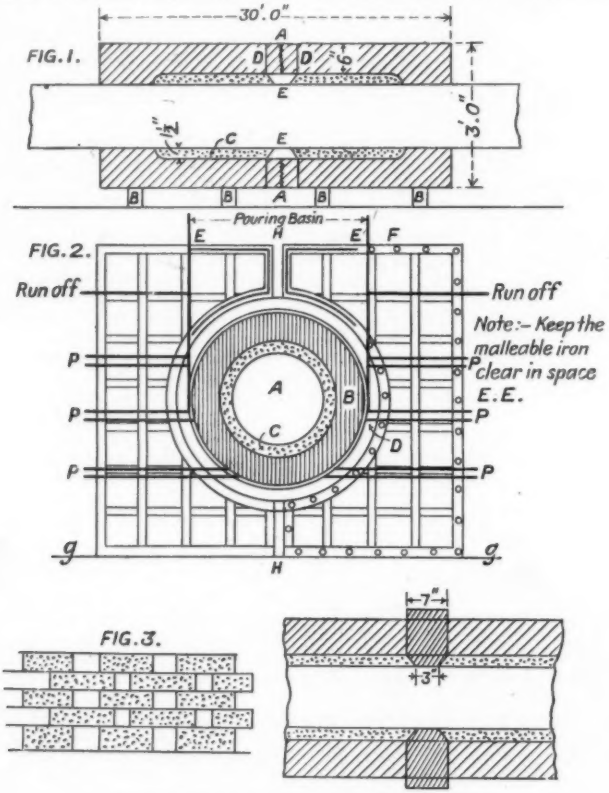
12. Some owners of foundries have informed me that they would have great difficulty in introducing analytical control into their works owing to the prejudices of the foreman. Of the foremen who hold such prejudices it may be said that they are working with their left hand only. If they themselves would demand analyses they would then be able to work with their right hand also. An analytical metallurgist in their works would be found as valuable in the conduct of the establishment as the secretary, accountant or the timekeeper.

THE BURNING OF A PLATE MILL ROLL.

By R. Shanks, Glasgow.

Some years ago, during a very busy period in a Clyde shipbuilding yard, one of the large plate mill rolls broke, as in Fig. 1, at A A, and the question of replacement had at once to be considered. The time it would take to make a pattern, and to mould a new roll, the boring, etc., was a delay which could not be afforded, owing to the pressure of work on hand. The firm called in the foreman moulder for his opinion, and he suggested that it should be sent to the foundry for burning.

The roll arrived on a Saturday morning, and was placed in the hands of a moulder, with instructions as to what was to be done. The first thing was to place the roll on four bars, which had been levelled up, as in Fig. 1, B, B, B, B. The fracture, Fig. 1, A, was opened by driving in steel wedges so as to admit the moulder's hands. The recess, C, Fig. 1, was then filled up with sand to D D, Fig. 1, about one inch clear of the fracture, and then finished into the shaft forming an apex, E E, Fig. 1. This was in order that there should be as little metal as possible about the shaft; also at each end of the recess two ¾-in. holes were bored to allow the gases to escape during casting, after which they were plugged up.



The Burning of a Plate Mill Roll.

While these preparations were going on, the moulder had made two gratings to mould up the burn with, as shown in Fig. 2, separated at H H. These gratings are right and left, with ½-in. malleable irons cast in around the outside of the right, which is cooled and set into the left, making a strong and reliable core iron. A strong iron was cast in, as shown in

Fig. 1, for lifting. A bed, *g g*, Fig. 2, having been struck, and a parting made, the mould was built up in loam, with three gate-pins P built in on each side for the iron to run off. Care was taken to keep the lowest one small, so as to ensure a constant supply of hot iron under the shaft. When finishing off the building a nice, clean opening, E E. Fig. 2, was made for casting purposes. The mould having been parted, a belt, 1 in. deep and 7 in. broad, was scraped out of the mould at the fracture to allow fusion on the outside of the roll, and also for turning off, so as to make a nice joint. The mould, when finished, was placed in a stove and dried. The roll was now prepared for heating, and the shaft coated with plumbago. A range fire was built with the bricks in loophole fashion, Fig. 3, around about the part of the roll to be burnt, say, 3 ft. on each side of fracture. The fire being kindled, was kept burning for about nine hours, by which time the roll was well heated up. The fire was then cleared away, and the mould placed in position, was bound with clamps and was ready for casting. As no time was to be lost, a 3-ton ladle of good hot iron was brought round, and a good high drop given. Care was taken not to strike the shaft when burning down the sides and under the shaft. When sufficiently burnt the lower run off was shut up with a boating rod, and so on, until the top was reached, when the ladle was empty and the roll was burnt. It was allowed to cool gradually, and stripped the next day and cleaned up, when it was found all right.

The roll was then sent into the engineering shop to have the burn turned off, also the amount cut off the ends which was opened for burning purposes. Fig. 4 shows the portion of roll at the burn before it left the foundry. The time taken to burn this roll was for four moulders,, 34 hours each. The roll arrived in the foundry on Saturday morning, and it was burnt on Monday night, sent into the engineering shop on Wednesday, delivered in the shipyard on Thursday, and placed in its position within one week. The cost was £30. The estimated time to replace it with a new one was one month, and the cost about £300. The roll is still working to-day.

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In April last, during the great fire at Toronto, the two-storey building of William Jessop & Sons, Limited, together with the entire stock of steel there were totally destroyed. A new building, however, is now rapidly approaching completion.

ON "PNEUMATIC TOOLS IN FOUNDRY PRACTICE."*

While the foundry the writer represents has not many up-to-date appliances, we are carefully working that way. Pneumatic tools can be applied to so many uses in the foundry that I will try and enumerate a few of the things that can be done with air and the tools that are convenient to use. Most of us have used or seen the sand blast for cleaning castings. It is a good thing to use when it is desired to remove the sand that adheres very closely to castings, leaving them a nice bluish colour. There are some objections to the use of the sand blast, among which is the fact that it is hard to get men to operate it, owing to the very large amount of dust they are liable to inhale. There are respirators to place over the mouth and nose, helmets and goggles to wear, but it is not a very desirable job at the best. But men can be secured for money. More wages may have to be paid to a man who operates the machine than to the ordinary labourer, but he may be worth it.

Next we come to the pneumatic chipper, with which one operator who understands the machine can trim more castings in a day than four men with hammer and chisel. There are some men so blind to any improvements or innovations that they object to the installation of any labour-saving machinery, and they refuse to operate the chippers. Their places have to be filled by new and inexperienced men who must be educated to use the machine, but it pays to be persistent and success will finally crown efforts in this direction. I wish to say here, do not insist on a new beginner using the pneumatic chipper all day to start with, for if a foreman does so he will have one man less the next day. Rather let him use the machine five or ten minutes, followed by a rest of five or ten minutes, for the first hour. Then let him use the hammer and chisel the balance of the forenoon. Have him try again in the afternoon for an hour, but if the vibration hurts his arm do not insist on his keeping the machine in operation. Thus work him into it gradually. Try the chipper yourself, and see how long you can stand the jar, then use your own experience as a guide in determining how long another human being will be able to keep at it. By using the chipper a little longer each day the man finally becomes accustomed to it, and will prefer it to the hammer and chisel, for he can do a much nicer job in a shorter space of time, and, if he takes

* From a paper read by Mr. C. H. Thomas before the New York Foundry Foremen.

any pride in his work he will prove a very valuable assistant in reducing the general foundry cost.

With a foundry piped for air the acme of perfection to be desired in the foundry is reached. It can be used to clean out the moulds in place of a bellows. It can be attached to a riddle. There are a couple of makers of pneumatic shaker machines, and as a tireless worker the machine cannot be beaten. Where a vibrator is needed on bench work the air should be run to the bench, the vibrator attached to the under side of the bench, a spring valve placed where the moulder can press his knee against it, and he will get a perfect lift every time. There may also be some loose vibrators placed around among the light floors, and they may be used to advantage on heavy work where a good clean lift is desired. Having a hose at each bench does away entirely with the cost of buying bellows for the moulder to throw on the floor and get broken or carried away by some of those who make it a business to confiscate everything loose in the shop, such as brushes, etc., that disappear nobody knows how and where.

By having air piped all through the foundry a spray may be used, the same machine being used to skin-dry work, thereby doing away with a large amount of unnecessary securing. Mix the blacking by using 6 or 8 parts of water to 1 part of molasses, adding enough blacklead or plumbago to thicken to the consistency of thin cream. This can be determined by experimenting until the right mixture is reached suitable for the work. It may be necessary to go over the mould two or three times to secure the proper coating. It should be tried on small moulds first, and it will soon be possible to get the mixture right every time. After having properly blackened the mould empty all the blacking from the spray can. Wash it out, being sure to remove all the water. Then fill the can with kerosene and light an ordinary torch or a piece of waste. Turn on the air gradually until a good spray is had, holding the spray to the flame of the torch until it ignites. Then proceed to skin-dry the mould, holding the flame so that it will not burn the surface of the mould, and in a surprisingly short space of time the mould will be perfectly dry. A little practice will put a man in shape to make clean, sound castings. Leave the drying until the afternoon. After drying the mould close and pour just as convenient. The longer it stands the more liable it is to draw dampness. I have used the spray very successfully on dry sand, blacking two moulds in five minutes that by the old method of swab and slicking would have taken two and one-half hours. We used a spray can made which cost us about £2 10s., and we paid for it in four days in the saving of labour alone, to say nothing of what was saved in blacking. These cans can now be bought for £2 and are a good investment. There are many cheaper cans on the market that will answer the purpose, but I would prefer to use the larger one, which holds over two quarts, has two handles, and is fitted with a valve so that the operator can control the supply of air, thereby getting just the desired amount of pressure to insure a perfect spray. We found that a pressure about equal to what a man would exert by expelling the air from his lungs was sufficient.

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A NEW USE FOR CRUCIBLE MIXTURE.

In "Graphite," a publication issued by the Joseph Dixon Crucible Company, of 26, Victoria Street, S.W., it is stated that a large brass casting foundry has made a unique use of Dixon's crucible mixture, by means of which they have almost entirely done away with the use of fire brick. A wooden cylinder is made and placed in the furnace. The space between the cylinder and the furnace wall is the same as that usually occupied by the fire brick. The crucible mixture is made into a mortar by mixing with water to which a small quantity of silicate of soda has been added—about half a pound of silicate of soda to a gallon of water. The mixture when thus prepared is poured into the space mentioned above. The silicate of soda causes the mortar to set quickly, and the wooden cylinder can soon be withdrawn and put aside for future use. By means of the cylinder any portion of the furnace lining can be repaired or rebuilt. The refractory nature of the crucible clay and graphite will insure a more durable lining than if made of fire brick, and one far more easily and economically repaired. In making repairs the wooden cylinder is not always required. The lower portion of the furnace, which is subjected to the greatest heat, and, therefore, most liable to give way, can be easily repaired by breaking away the worn parts and the cracks and holes filled with the mortar made of the crucible mixture. In some foundries the brass furnace is of the same diameter as a straight-sided charcoal barrel, and such a barrel may be used in place of the wooden cylinder, and the barrel left in and the fire started at the proper time.

EMMERT'S PATTERN-MAKERS' VISE.

In the annexed illustrations are shown some views of Emmert's Patent Vise, which is being put on the market by Mr. Herbert Taylor, of 2, Powis Buildings, Macklin Street, London, W.C. This vise in position on the side of the work bench is just flush with the top of the bench and

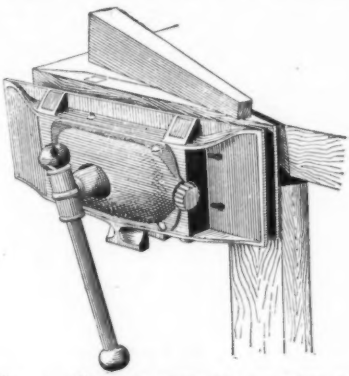

FIG. 1.—NORMAL POSITION OF VISE ON BENCH WITH JAW AT AN ANGLE FOR TAPERED WORK.

presents no obstruction. In this position it can be unlocked in an instant and swung around the complete arc of a circle the plane of which is vertical. By simply pulling a lever it will travel 90 degrees in the arc of another circle, the plane of which is also vertical, but at a

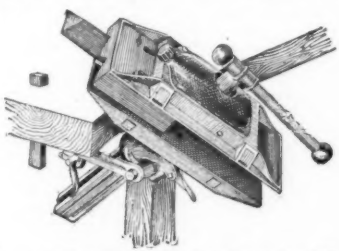

FIG. 2.—VISE HOLDING ODD SHAPED WORK IN A FORM AT AN ANGLE.

right angle to the plane of the former circle. This brings the vise into a horizontal position where it will swing around the complete arc of a circle, and at any point on the arc of 90 degrees, mentioned above, it will swing 180 degrees. At any point in the paths traversed by the vise it can be locked as firmly as though that were its only position, thus enabling the workman to have his work in the most convenient position without removing it from the vise.

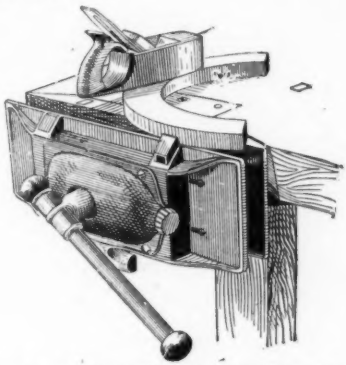

FIG. 3.—A VERY CONVENIENT POSITION TO HOLD BOXES OR DRAWERS.

A man works accurately when the different members of his body are in their natural position. For example, in an operation on an angle, compelling the workman to throw up his arm as the strain increases, so will the accuracy and output of finished work decrease. To

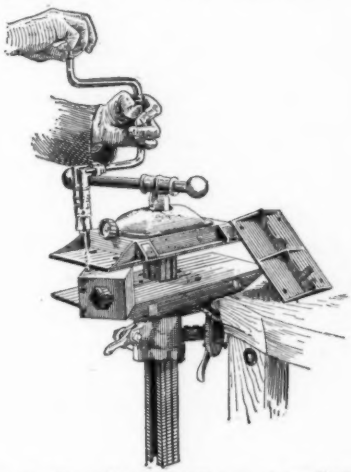

FIG. 4.—VISE HOLDING WORK TO BE BORED IN A VERTICAL POSITION FOR THE SAKE OF ACCURACY.

overcome this difficulty the workman has been compelled to unlock his work in the vise, take it out, turn it, adjust its parts and lock it back in a new position. But

this takes time. In fact, it often takes more time to handle and adjust it part to part than it does to do the work. A little of this loss can be saved by quickening the movement of the jaws, but that is simply saving a portion of the loss. This lost time adds to the cost of the product, but not to the value.

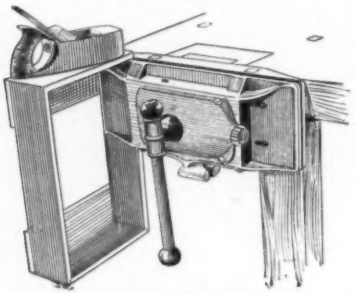

FIG. 5.—ANOTHER POSITION HOLDING SIMILAR WORK.

The vise is made of iron and steel, and weighs about 80 lbs. The main jaws are 7 in. by 18½ in., smoothly planed and moving normally parallel, and open 14 in. The screw sleeve runs through the centre so that the operator can place his work on either side, making it a right- or left-handed vise. Of the main jaws, the moving one is fitted with a device which throws the jaw out of parallel to permit the gripping of tapered work. The fixed or inner jaw has a V-shaped groove cut into its face to accommodate a tilting plate, which adapts the vise to grasp wedge-shaped work having two angles, and various other irregular or complex shapes. When special or peculiar shapes are to be held, wooden blocks shaped to conform are made and screws run into the back of these. In each of the larger jaws there are slotted holes to hold the heads of these projecting screws.

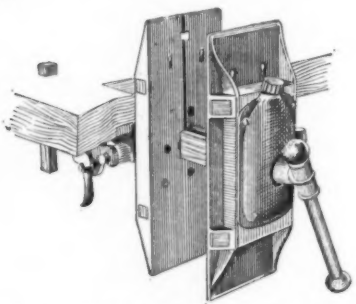

FIG. 6.—VISE REVERSED TO HOLD WORK ABOVE THE BENCH.

Apart from the main jaws there are a pair of 2½-in. steel-faced jaws for holding metal work. Metal work can also be held in the main jaws of the vise by using wooden pads hooked into the slotted holes. There are also two 1 in. square pins in each of the large jaws which can be pushed into place and are very useful for holding circular work or in compressing glued parts. It will thus be seen that each vise, independent of loose pieces, has one pair of 18-in., two pairs 7-in., one pair of 2½-in. steel faced and two pairs 1-in. jaws, making in all six pairs of jaws.

The workman who has the use of one of the vises is as thoroughly equipped as though he had access to a dozen different vises in as many different positions, without being encumbered with a lot of useless tools.

The illustrations show the vise in six different positions, though these are not all. It is susceptible of fourteen different fixed positions in an instant insuring quickness of movement and great stability.

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HOPKINSON & COMPANY, LIMITED, have just taken possession of their new premises near Huddersfield.

JAMES HOWARTH & SONS, LIMITED has been registered with a capital of £12,500, in £1 shares, to acquire the business of tool and steel manufacturers carried on by James Howarth & Sons, at Broomspring Works, Sheffield.

THE POWER-GAS CORPORATION, LIMITED, have received an order from the Tranmere Bay Development Company, Limited, of Birkenhead, for a gas-driven electric installation for the latter company's new shipyard at Birkenhead.

THE Judicial Committee of the Privy Council will hear on May 9 the petition of John Brown & Company, Limited, for the extension of the term of certain Letters Patent granted to Mr. J. D. Ellis, the managing director of the company.

THE output of plates from the three works of the South Durham Steel and Iron Company, Limited, at the present time, is over 1,000 tons per day, and, if finished material is included, the output is represented by the large total of 7,500 tons per week.

SUCCESSFUL WORK ON INTRICATE CASTINGS.

An ingenious foundryman, Mr. D. Galvin, has produced some noteworthy castings from a skilful handling of just plain everyday sand, wood, and hot metal. One of the castings which is representative of his ability is here illustrated. It may be mentioned that Mr. Galvin makes the patterns in his leisure following the regular daily work in the foundry where his stint is by no means small and fragile castings. When he made the sketches here shown he states he was engaged during the day on the production of a 4,000-lb. Corliss engine cylinder, and had, in this latter instance, the pattern-making assistance of a house carpenter.

The height of the loosely jointed casting here illustrated is 12 in. from the base to the tip of the acorn-shaped ornament at the top. The combination is 4 in. wide. The hollow bill is $1\frac{1}{2}$ in. diameter, and the enclosing cage has an exterior measurement of $1\frac{3}{4}$ in. The three sketches, Figs. 2, 3, and 4, show the arrangement of the different parts of the pattern and the core box, in the assembled, as well as dissected, order. There are not many parts, and Mr. Galvin made in one day—moulding and pouring—three castings shown at St. Louis Exhibition, and has made several in cast iron as well as brass. The photograph was taken from one cast from brass.

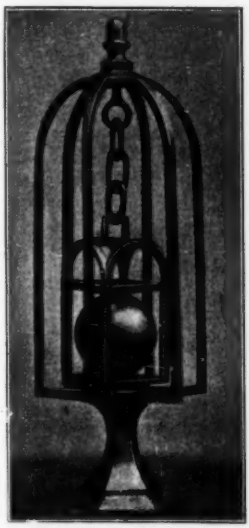

Fig. 1.—The Casting.

The reference letters are the same in each engraving for the designation of identical parts. The match board is seen at A, and B is the core box, showing the arrangement of the patterns in place. C is the end of the core box, and D is the gate made in the core for hollowing out the base. E is the bottom plate of the pendant supporting the ball. F shows a section around the ball, and G is the outside arch. H is employed for making

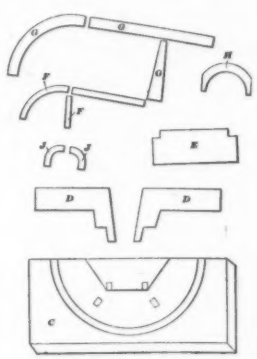

Fig 4.—The Pattern Dissected.

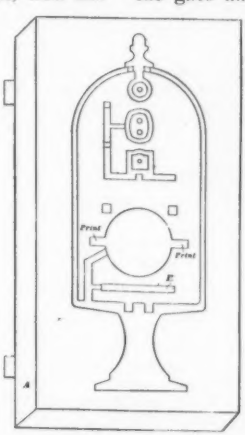

Fig. 2.—The Match Board.

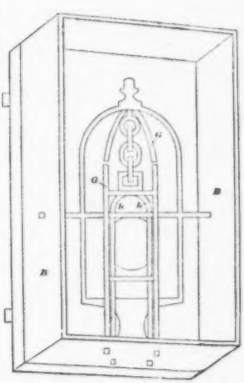

Fig. 3.—The Core Box.

the circle at top of the pendant, and J is the link pattern.

The ball is hollow and is poured through the base. It is obvious how the metal flows to the several parts through the neatly contrived gates. There are three loose links in the chain and two of these are poured with a horn gate. The square holes shown in the core box and match board are for the purpose of withdrawing some of the pattern pieces. When the gates are finally cut away from the casting, and their location becomes somewhat difficult, owing to the finishing of the metal surface, it is easy to see that the device becomes considerable of a moulding puzzle, and in this respect Mr. Galvin has designed an intricate pattern capable of quite satisfactory results.—"Iron Trade Review."

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DARTIUM.—A NEW ALLOY FOR MAKING STEEL CASTINGS.

In a recent issue we gave a brief account of Dartium alloy, for which exceptional qualities are claimed. We have now secured some fuller details. Dartium alloy is the invention of James W. Chenall, M.Inst.C.E., a well-known metallurgist. It enables the ordinary iron founder to be independent of the steel foundry, and to manufacture steel castings as promptly as brass castings. Engineers' machine shops can make their own tool steel from material until now of little value, and it is claimed that cast iron can be greatly improved in strength and elasticity. Malleable cast iron castings as well can be made equal in tensile strength to ordinary mild steel. Engineering works can thus use up all their steel and wrought iron scrap to great advantage. The cost of alloy is reasonable, and "Dartium Steel Castings" are being made at several foundries in the Midlands and the West of England, and the results are said to have absolutely proved the efficiency of the process.

Below are the results of several tests, illustrating the value of the alloy for various purposes.

Dartium Mild Steel Castings made from mild steel scrap.—Tests made at the Brunswick Testing House, Wednesbury, belonging to the Patent Shaft & Axletree Company, Limited, showed that the average breaking tensile strain of eight bars tested was 27.2 tons to the square inch.

Iron Castings, with Dartium Alloy Added.—The original cast iron had a breaking tensile strain of 4.9 tons to the square inch. With Dartium added, No. 1 bar showed 9.5 tons to the square inch; No. 2 bar showed 6.4 tons to the square inch; No. 3 bar showed 7.3 tons to the square inch, and No. 4 bar showed 6.1 tons to the square inch. Transverse tests with the usual standard test bar gave a breaking load of 3,800 to 3,900 lbs. Tests made at Messrs. Robey's works, Lincoln, showed an increase of about 200 lbs. on the transverse breaking load.

Malleable Cast Iron Castings, with Dartium Added.—Tests made at the Sheffield Testing House, Sheffield, showed that malleable cast iron, with an original breaking tensile strain, of 18.91 tons to the square inch, with Dartium added, gave 25.19 tons to the square inch.

The alloy is manufactured in qualities suitable for various purposes, viz. :—

The manufacture of Dartium malleable steel castings.

Ordinary and high quality tool steel.

The increase of the tensile strain of malleable cast iron castings, and of ordinary cast iron.

In the manufacture of Dartium steel castings the quantity of carbon in the scrap employed governs the quantity of Dartium alloy required. When Bessemer or open-hearth scrap, containing, say, from 0.45 per cent. to 0.50 per cent. of carbon is utilised, then the quantity of Dartium alloy required will be from 5.0 per cent. to 7.5 per cent. If the stock used be lower in carbon, a larger quantity of Dartium alloy must be employed—for instance, if open-hearth very mild steel, containing under 0.20 per cent. carbon be the stock, then from 10 per cent. to 15 per cent. of Dartium alloy must be used. Stock or scrap falling still lower in carbon, a higher quantity of Dartium alloy be used with advantage. The use of good, clean, low carbon, open-hearth steel scrap, boiler plate scrap, or scrap from mild steel stampings is recommended. If wrought iron scrap be the stock utilised for the production of cheap malleable castings, 12 to 15 per cent. of Dartium alloy will be required.

In the production of high quality tool steel, great care should be exercised in the selection of the materials it is intended to utilise for such purpose. Open-hearth mild steel having low percentages of carbon and manganese should be employed, such as is used in the manufacture of steam boiler plates. A steel made from good quality mild steel scrap (boiler plate) with from 15 to 25 per cent. Dartium alloy, will, it is said, take any degree of hardness in tempering (tempering by quenching), and while the cutting edge may be exceedingly hard, the body of the tool from near to the point will remain

as soft and ductile as the best quality mild steel. An addition of 11 lbs. of "Dartium" to 30 lbs. of malleable cast iron has increased the tensile strength 30 per cent., and the elongation from 1.5 to 2.5 per cent. Malleable cast-iron castings can thus be made in tensile strength equal to ordinary mild steel. A tensile strength of from 25 to 30 tons to the square inch may be readily obtained.

For increasing the tensile strength and elasticity of cast iron from 3 to 5 per cent. of Dartium alloy gives very satisfactory results, greatly increasing the elasticity of the cast iron, and increasing the strength 15 to 20 per cent. In special cases as high as 10 per cent. Dartium may be used to advantage.

We hear that this alloy is being used by many iron and steel founders with considerable advantage. We have seen a number of testimonials from well-known manufacturers indicating their satisfaction after careful tests. One, having crucially tested it for 12 months, states that he is erecting buildings and plant to produce Dartium steel castings in a large way. Another firm states that after eight months' experience in making Dartium steel castings, they are preparing to alter all their crucible furnaces, to enable them to go largely into the manufacture. Several firms in the Midlands are erecting suitable furnaces, and a number are putting blast under existing brass furnaces to enable them to make small steel castings and tool steel.

We therefore feel that this is a subject which will interest many of our readers, and, consequently, give the above details on the authority of Messrs. J. H. Hackworth & Company, of 46, Queen Victoria Street, E.C., the sole agents for London and district and export.

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A. & J. MAIN & COMPANY, LIMITED, of the Clydesdale Iron Works, Possilpark, Glasgow, are supplying the steel buildings complete for the new workshops for the Britannia Royal Naval College, Dartmouth. This extensive range of buildings includes pattern shop and foundry.

A SERIOUS explosion took place recently at the Cleveland Steel Works of Messrs. Bolckow, Vaughan & Company. It appears that the first of the two new American furnaces was being blown in under the supervision of Mr. R. S. Pollard, representing Messrs. F. C. Roberts, of Philadelphia, when an explosion occurred, killing Mr. Pollard. Mr. A. Windsor Richards, the works manager, who was present, had a narrow escape.

FOUNDRY BLACKINGS.

By N. W. SHED.

WHAT are blackings made of? The question is commonly answered by saying, blacklead or plumbago. It is true that many blackings contain more or less blacklead; but, on the other hand, it is true that a great many blackings contain no blacklead at all. The question might be answered by saying coal. This answer would be nearer right, for probably three-fourths of the blacking used in the United States is made out of pulverised anthracite. Coal is generally regarded as being quite uniform in composition, yet there is a marked difference in the various hard-coal blackings.

Samples of the good and poor blacking, on being sent to a foundry chemist, gave these results:—

GOOD BLACKING.

Ash	10 per cent.
Solid carbon	82 ,,

POOR BLACKING.

Ash	18 per cent.
Solid carbon	75 ,,

This proved that there was a decided difference in the blacking, and also showed that the blacking with low ash and high carbon kept the sand from sticking to the casting. The poor blacking was made of a slaty, hard coal; this is the refuse of the anthracite washeries, and can be obtained for little or nothing. The good blacking was made from a good quality of anthracite.

For some classes of work, such as ingot moulds, an inferior blacking will do very well.

For small castings, requiring a very smooth surface, a much finer quality of blacking is used. These blackings contain a large quantity of plumbago, yet the blacking maker is prone to put in as small a quantity of plumbago as possible, and yet have the blacking fill the bill. A plumbago blacking, called by the trade pure plumbago, had this composition:—

Ash	47 per cent.
Volatile matter	7 ,,
Solid carbon	46 ,,

This is very far from pure plumbago, which should be 100 per cent. carbon or graphite. It is very common to find 50 per cent. soapstone in plumbago blackings. In fact, there is very little pure plumbago sold for foundry use. It would seem reasonable to demand that when pure plumbago is wanted it should be at least 75 per cent. pure.—"The Foundry."

HIGHAM'S HOT BLAST CUPOLA.

Mr. Higham, of Messrs. Higham & Simpson, ironfounders, Broom Lane, Levenshulme, has recently patented a new form of foundry cupola, the design

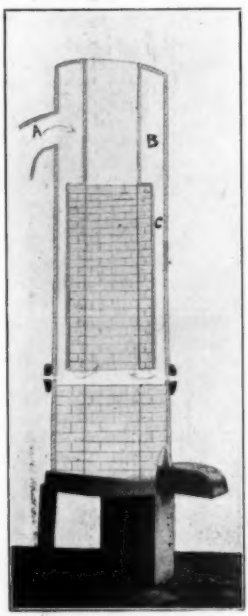
Higham Hot Blast Cupola.

of which is shown in the annexed illustrations. The improvement consists of the application of a jacket to the upper part of the cupola by means of which the air supply to the tuyeres is warmed by heat which is usually radiated and lost before it is delivered at the tuyere openings.

In the cut A is the inlet from the fan, B is the cast iron belt, lowered in from the top, while C are cast iron pipes, built in behind the bricks, loose, to allow for expansion. It is simple to fix, and also much easier to work than a cold blast cupola. There is no trouble to keep the tuyeres clean, and the founder can always rely on hot metal, no matter what the state of the atmosphere may be, because the air is dry.

The cupola has been working regularly at Messrs. Higham & Simpson's foundry since October 8, 1903, with no expense for upkeep beyond ganister for daubing the melting zone, which is not above 6 in. higher than the tuyeres marked on photo. They have melted 2 tons of metal with 5 cwts. of coke, bed included, not allowing for the residue of coke picked out afterwards. In a large cupola altered to this principle they have melted 3 tons with 6 cwts. of coke, bed included. Previous to the alteration it required 10 cwt. for the same amount of iron melted. The temperature of wind averaged 212 degrees Fah.

Describing a further test made a few days ago, Mr. Higham writes: The bed was weighed and it scaled 3 cwts., and measured 2 ft. above the tuyeres. Upon that 3 cwts. of pig-iron (15 pieces) were put, and 7 cwts. of heavy scrap. That was the first charge. Afterwards, ½ cwt. of coke to 10 cwts. of iron was charged. The fire was lighted at 12 o'clock, and we commenced blowing at 3.30 p.m. We tapped out at 4 o'clock 8 cwts. of metal and cast two small flywheels, which are turned and polished on the rim and boss. Some idea may therefore be formed that the metal was fairly hot. When we have



Higham Hot Blast Cupola.

finished melting and the tuyeres are inspected it is possible to see through the cupola. There is no coke remaining above the tuyeres, because it melts right to the finish, an additional proof of how low down the melting zone is.

"TYPE"-SHELLS AND BRASS INGOTS.

DID you ever buy any brass ingot from a "refiner" and accidentally drop it on the floor and have it break? If you have, it is quite probable that the ingot was made from "type"-shells. Some ingots made from "type"-shells will not show this characteristic feature, as other material may have been used in its manufacture to "fatten" it up. A "type"-shell ingot, however, will usually respond to this critical "drop" test and its pedigree may be known thereby. The "type"-shell brass ingot usually is obtained when a bargain has been found. The ingot may have a good appearance, but the castings which are obtained from it beggar description. They usually come out of the sand with drops of lead on the surface, but it will be found that they generally have good "cutting" qualities. We recently saw a plater trying to dip some castings made from "type"-shell ingot so as to obtain a bright surface upon them. The more he dipped the blacker they got, until he gave up in despair and thought that there must be something radically wrong with the dip. The surface of the castings contained so much segregated lead that when dipped they had the appearance of a leopard. As a leopard cannot be made to change its spots, so a "type"-shell ingot cannot be made to alter its character.

FIG. 1.—AN ELECTROTYPE.

Nearly everyone is familiar with the article known as an electrotype. It is used for printing in place of type. An impression of the type is made and this is plated with copper. After a thick coating of copper is obtained, an exact reproduction of the type is had. This thin shell, however, is too fragile to stand the force required in printing, so that a reinforcement is necessary. This is accomplished by means of electrotype metal or "backing" as it is usually called. This electrotype metal or "backing" is an alloy of lead, antimony, and tin, and is poured into the copper shell so that a thickness of an eighth of an inch or more is obtained. The whole is then fastened to a wood block.

In Fig. 1 an ordinary electrotype upon a wood base is shown. The copper is a mere shell. It is rarely over 0.005 in. in thickness and often is less in poor electrotypes. This is usually sufficient to withstand the pressure of the printing press when backed with good electrotype metal.

As nearly all newspaper advertisements, or any other printed matter which is made in large amounts, are printed from electrotypes, it will be readily seen that a large amount of them must finally find their way into the scrap metal industry. The printers sell them, block and all, to the scrap man, who places them in a pile and starts them burning. The wood of the base furnishes the fuel, and the heat melts the soft electrotype metal so that it runs down into a receptacle and is saved. The copper in the electrotype does not melt but remains intact. One naturally might think that all of the electrotype metal would melt away from the copper shell, but this is not so. Much remains, and an examination of old shells will reveal this. The soft metal adheres tenaciously to the copper, and forms a coating which heat does not remove. From the appearance of a lot of "type"-shells one would believe that the amount of soft metal which coats them would not be over a few per cent., but in reality there is a large amount. This amount naturally depends upon the care that is used in melting the soft electrotype metal out, or "sweating" as it is called in the scrap metal industry. To show that a large amount of soft metal remains on the shell, the following analysis will suffice. The samples looked fairly clean :—

FIG. 2.—TYPE SHELLS.

	COPPER.	
Sample A	41.89	per cent.
Sample B	28.38	,,
Sample C	59.99	,,

The balance of the shells was principally electrotype metal with a little dirt which naturally adhered to them. To show what kind of metal "type"-shells will make when melted, a very choice lot of them was melted and poured into ingots, and borings

from them were analysed. The results are as follows :—

Copper	61.76 per cent.
Lead	30.97 ,,
Antimony	5.12 ,,
Tin	2.15 ,,

It will readily be seen what kind of ingot metal of any description "type"-shells will make. The fact that "sweated" shells can be purchased for about 2½d. a pound and that they have the appearance of pure copper, renders their use in the manufacture of brass ingot metal attractive. Although a large amount of "type"-shells are used for such a purpose, they are only fit for use in the manufacture of casting copper by the regular copper refining process of the orthodox copper smelter. In Fig. 2 is shown a lot of "type"-shells.—"The Brass World."

THE OLIVER WOOD TRIMMER.

The annexed illustrations show the Oliver Wood Trimmer, as made by the Oliver Machinery Company, 10, Deansgate, Manchester. The tool is supplied in several sizes, some being bench tools, while the No. 3 size, shown in Fig. 1, is mounted on an iron pedestal. Fig. 2 shows an end view of the knife carriage and shows the bevel bearings above and below, as well as the end of the long taper

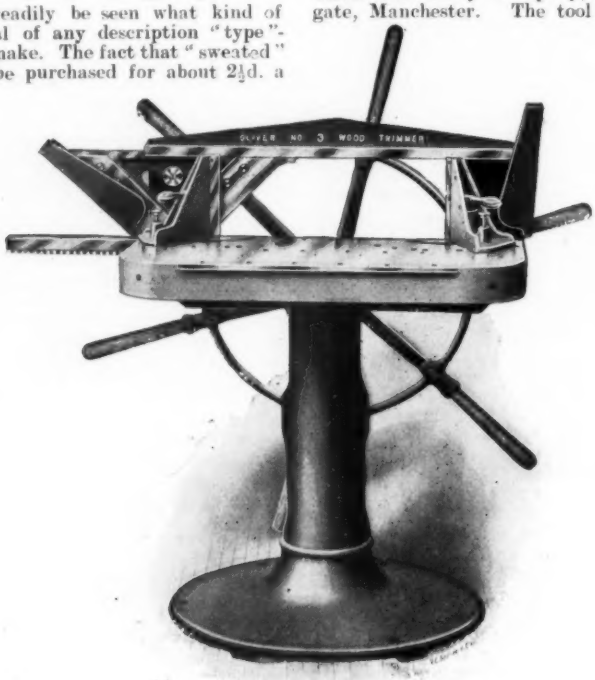


Fig. 1.—Oliver Wood Trimmer, No. 3 Size.

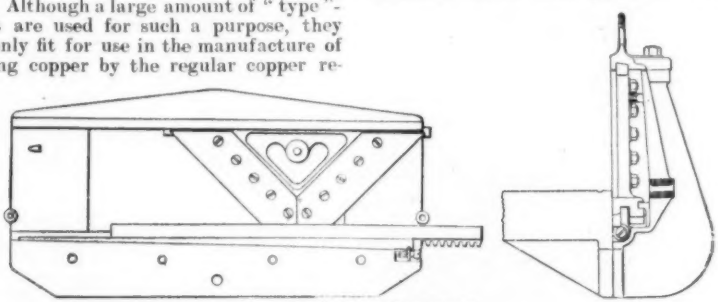


Fig. 2.—Knife Carriage.

key which is adjusted by the shoulder screw shown. The long taper gib is not only tapered in length, but bevelled in breadth as well, so that operating the screw shown takes up the wear or loose-

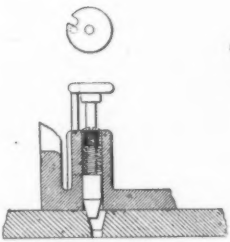


FIG. 3.—TAPER PIN.

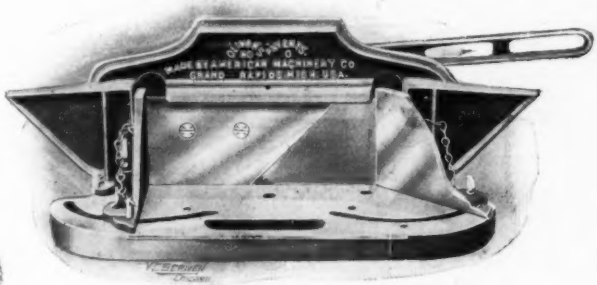


FIG. 5.—MACHINE FOR USE AS A BENCH TOOL.

ness both up and down and sideways. This, it is claimed, ensures a tight bearing at top, bottom, and both sides, or, in other words, perfect accuracy of work during the life of the machine.

Taper pins, Fig. 3, fitted with a compression spiral spring are so arranged in each gauge that if let loose when in nearly the desired angle the spring forces the taper pin into a tapered hole in the bed as the gauge is swung over the hole. These tapered holes are made after the absolutely correct position of this gauge has been found by cutting pieces, and they are made while the gauges are still in this position. By this means accuracy is obtained which is unapproachable in any other way.

Fig. 4 illustrates how the No. 3 full universal trimmers are graduated. The degrees cover both acute and obtuse angles, with the prominent ones such as

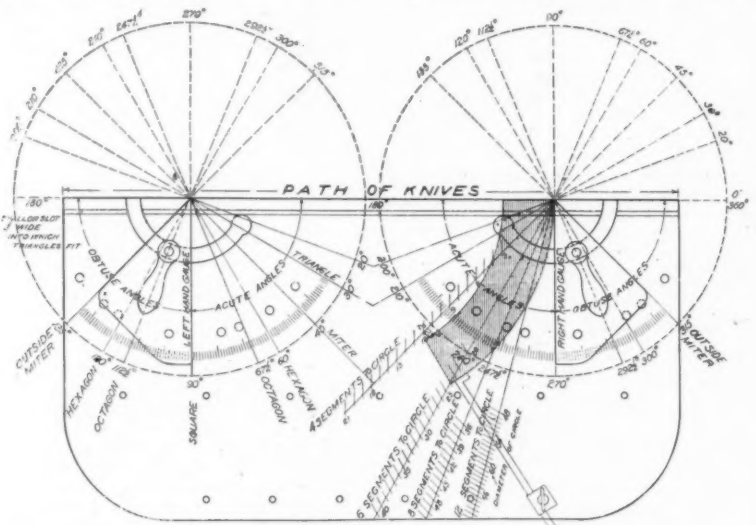


FIG. 4.—GRADUATIONS ON THE BED OF NO. 3 OLIVER WOOD TRIMMER.

square, octagon, hexagon, mitre, etc., located by means of the spring stop pin. Four, six, eight or twelve segments to any circle from 3 to 70 in. in diameter may be accurately jointed by using the

auxiliary stop gauge. The illustration represents one of six segments to a 24 in. circle, properly adjusted. In operating, one end is trimmed first, then the work is turned end for end, and finished to the graduation mark.

The auxiliary gauge or stop is supplied with every No. 3 trimmer, and by its use any number of pieces can be trimmed to exactly the same length. The machine is operated by a six-spoke hand-wheel. By this means the capacity does not interfere with ease and convenience of operation on small work. On the contrary, it makes it even more satisfactory for the smallest work than any small trimmer, for, whether your piece is 2 in. or 20 in. wide, a handle is always within easy reach, ready to grasp. In trimming long pieces in a crowded shop the ease with which the whole top of the machine can be swivelled upon the column is of great advantage.

On the No. 3 Oliver Wood Trimmer the range angles that can be trimmed is from 30 degrees to 135 degrees on each side of the bed. It cuts 20¾ in. wide, and 7½ in. high. The gear, rack, and all working parts are protected from dirt and chips. Automatic knife guards protect the knives on both sides whenever they pass beyond the frame. When the knives do not thus project, the guards are up close to the machine, thus avoiding both breakage and wasting shop room.

In Fig. 5 is shown a machine suitable as a bench tool. While light in weight, it is strong, rigid, and durable. It covers the acute angles between 35 degrees and 90 degrees, and the obtuse angles between 90 degrees and 135 degrees.

The length of cut is 6 in., and the height of cut is 3 in. The size of bed is 6 in. by 16 in., and the height over all is 7 in.

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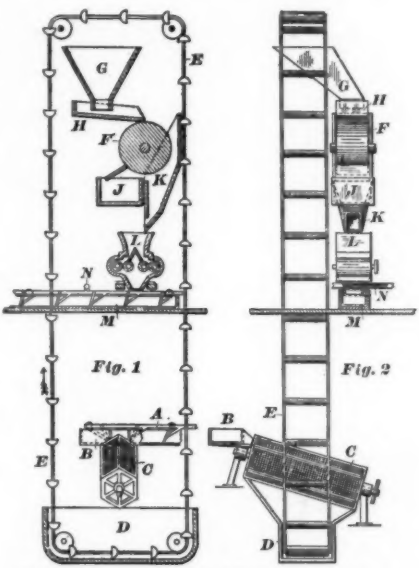
On February 25, Messrs. I. Storey & Company, of Manchester, accepted an order from a shipbuilding firm for an auxiliary condenser of 900 square feet, delivery to be made by March 13. The whole plant was made and delivered by March 10.

The extension of the mill plant at the Cargo Fleet Works is making rapid progress, the whole plant assuming very large proportions. The Talbot Steel Furnaces are near completion, and the company expect to make ingots before the end of June. The cogging mill plant is also well on the way.

RENOVATION OF MOULDING SAND.

The treatment of moulding sand after it has been used in making castings is the subject of a recent patent granted to Frank E. Johnson, of Greensburg, Pa., U.S.A. The inventor in the preamble to the patent specifications says that in the making of sand moulds by machinery and the handling of the moulds and sand by conveyor apparatus in order to form a continuous process in moulding, the agitation of the sand causes it to become "coarse," and such sand rolls up into small round



The Renovation of Moulding Sand.

shapes like shot. This is caused by the new sand added from time to time to give the necessary strength; the new sand being of a clayey nature gathers the coarse sand into balls. When the sand reaches this state it is well-nigh impossible to hold it together for moulding purposes, and the castings are very rough. The object of the invention is to overcome these objectionable features and treat the foundry sand to bring it back as nearly as possible to its original state when first used, and particularly when the sand is to be carried away, treated and returned by conveyor apparatus to be used again in continuous operations.

Fig. 1 is a face view of the apparatus for

conveying sand as suggested by the inventor, and Fig. 2 is a side view. The machinery consists of the hot sand or lower conveyor A provided with a number of flights and adapted to travel within a trough B. Leading from the trough is a chute connecting with a hexagonal riddle C mounted in supports and capable of rotation. Below and extending up to the riddle is a boot D and within the latter are sprockets for the elevator E; as the patent describes it, "the lower end of an endless elevator" passes around the sprockets. The elevator is equipped with buckets in the usual manner. The upper part of the elevator passes over another set of spockets, and below this upper end and outside of the path of the elevator is located a magnetic separator F. The separator has a hopper G with a discharge opening leading to an agitator H. The agitator is inclined and the lower end extends to a rotating roll having a magnetised face at F. Underneath the roll is a box J with a scraper engaging the face of the roll above. Fitting under and around the other side of the roller in the magnetic separator at F is a chute K leading to the grinding apparatus. This last is mounted in a casing with a hopper L at the upper end. Below the hopper are the two sets of grinding rollers, the inner rollers rotating at a slower speed than the outer ones. Under the rollers is another chute leading to a conveyor moving in the trough M.

After the moulds have been made in the moulding machines they are generally placed on a conveyor and the castings poured in that position. The conveyor carries the moulds containing the hot castings to a grating, and by the time they reach their destination the castings have sufficiently cooled to be dumped. The hot sand passes through the grating into the trough B containing the conveyor A, leaving the castings upon the grating. The conveyor carries the hot sand to the hexagonal riddle at C and the elevator E in turn takes it up to the separator F and the trapped particles of metal are scraped off and deposited in the box at J, while the sand proceeds to the grinding apparatus and thence to the conveyor in the trough M. The sand is ordinarily tempered with water before re-using, and the water may be supplied at any stage of its progress from the dumping grating to the moulding machines. In the engravings the water supply is indicated at N above the trough M, the conveyor being relied upon to thoroughly mix the sand and water before its return to the moulding floor.

CHEMISTRY IN FOUNDRY PRACTICE.*

By N. W. Shed.

The last fifteen years have brought a great change in the making of cast iron. Before 1890 little attention was given to the different grades of cast iron, but since that time machinery manufacturers have demanded a hard, wear-resisting metal and also a soft metal which may be easily machined. The control of this metal is governed by its chemical composition, and for this reason chemists have come from the blast furnace and steel-making plants to the foundry.

The grading of iron by fracture was one of the difficulties in the old method of mixing. At one time there were nineteen different No. 1 irons. They varied from ½ per cent. of silicon to 4 per cent., and were all No. 1. No. 3 in one brand would match No. 1 in another. No. 1 and No. 2 were usually confused, and often No. 1 was supplied for No. 2, and the founder paid the No. 1 price. When we know that two or three grades of iron can be distinguished on a single pig, when we know that a No. 3 grade can be transformed into a No. 2 grade by slower cooling, when we know that iron cast in a dry pig bed is a lower number than iron cast in a wet pig bed, we can form some idea of the difficulty of grading by fracture.

It would be interesting to know how many foundrymen still cling to this method of grading iron. No doubt many think that the iron is graded by fracture, but, if the truth were known, every ton they receive is graded by analysis. But this handling of iron by number and by tradition is unknown to the mixer by analysis. The chemist ruthlessly cuts into the iron with two acids, separates the graphite, silicon, sulphur, phosphorus and manganese and marshals them into columns, and now the mixing is simply a pairing off of these substances.

A high silicon with a high phosphorus; a low silicon with a low phosphorus; a high manganese with low sulphur; a high manganese to carry off sulphur; low silicon and low phosphorus for strength; high silicon and high phosphorus for softness; a low silicon and high manganese for close grain.

Nothing is left for guess. A formula is decided upon and the various irons are figured to so mix that the result shall not vary over one-tenth of one per cent. The old method was more picturesque, but the

* Read at meeting of Buffalo Foundrymen's Association, Feb. 21.

modern method is more sure. There are foundrymen here who will admit that mixing can be done better by analysis, but they say the blast furnace people make the analysis of every load of pig, and that is good enough for them. This may do in making the softer grades of iron, but when it comes to making hard iron the furnace analysis is seldom reliable. The fact is the analysis given of the load is not an analysis of the pig in that car, it is simply an analysis of the cast from which that load was loaded. As one cast of iron may vary, it is easy to see that a man may get a carload of iron of which the furnace analysis is 1.50 silicon, but the actual analysis is 1.00 silicon. If he goes on the supposition that the furnace analysis is right, he will get white iron if he uses any hard scrap, and he will probably get all his light castings white if he uses nothing but pig. These cases are happening every day. Castings that should be 1.25 to 1.60 per cent. silicon, have finished below .70 silicon because the furnace analysis did not represent the car. The blast furnace sample is taken from the liquid metal as it runs from the notch at the furnace, and though the analysis of that sample doubtless is correct, yet that sample is very different from one obtained from the car itself. Another disadvantage of relying on the blast furnace is that the furnace people will claim that the only satisfactory iron is supplied by them. The claim is often made that the ores, limestone and even air used by them have a marvellous power to give both strength and softness to the iron, while ores and air of a rival furnace have no such power. If this claim is admitted by the foundryman, he is at the mercy of the pig-iron maker, and the blast furnace fairly owns the foundry. This shuts out the foundry from the open market when prices are much lower. If the foundryman is free to buy, he can often pick up lots of off malleable or off basic iron which he can use to advantage. In the same way, many lots of scrap, two or four dollars below the price of pig, may be picked up and the right pig bought to go with it.

But the great value of the chemist to the foundry is in the making of special irons.

Some castings must be very strong, some must resist corrosion by acid or alkalies, some must expand and contract with sudden change of temperature. This requires a careful balancing of the different elements in the irons, and in many cases the correct amount of manganese will solve the problem. A special iron much heard of lately is semi-steel. The name is a poor one, but like many other poor names, it seems to stick. It is practically not steel at all. It is simply a cast iron strengthened by melting steel with it. It generally gives a foundryman a creepy feeling to melt steel with pig-iron, but when he gets up his courage, he finds the metal clean, close-grained and strong and not a bad imitation of air furnace iron. Semi-steel should have a definite composition and its real value is in the low graphite. The plates of graphite scattered through cast iron tend to weaken it, and if the amount of graphite is lessened the iron becomes stronger. Even in running a cupola a chemist may be of value. Cupolas are slagged with limestone or fluorspar as a flux. The amount of limestone is generally given by the chemist. The coke ash should be fluxed as well as the sand on the pig. The old way was to add a shovelful of limestone to every charge of iron, but now from 100 to 200 lbs. of limestone are added to a charge, the amount depending on the coke ash and upon the amount of scale and sand on the pig-iron and scrap. Lime, if properly used, will absorb some sulphur from the coke and will also save iron from going into the cinder. This may be considered a small point, but it means saving many tons of iron in the course of a year.

But the coke sampling is the most important. Many cokes are sold with 1½ to 2 per cent. sulphur, which means a moderately low silicon, white iron castings. Sulphur should not go above .75 per cent. in coke, and many foundrymen find out that the coke is poor after they have made two heats of white castings; then they test the coke. This is much like locking the door after the horse is stolen.

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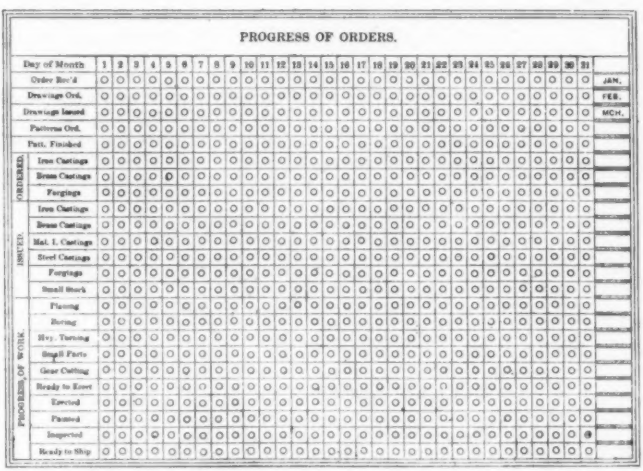
THE STEEL COMPANY OF SCOTLAND, LIMITED, have placed a contract with Mr. P. J. Mitchell, of 52, Queen Victoria Street, London, E.C., for an installation of Rateau patent exhaust accumulator regenerators, together with the necessary turbo generating plant, condensers, cooling tower, etc.

A "WEARDALE" patent heating furnace and gas producer is to be erected at the works of the Leeds Forge Company, Limited, the furnace to be constructed to heat plates to an even temperature from end to end for flanging. This plant will be supplied by W. F. Mason, Limited, of Manchester, who are also supplying gas producers and "Weardale" patent heating furnaces for the works of The Giles & Ward Foundry Company, Limited, Birmingham.

KEEPING ACCOUNT OF THE PROGRESS OF ORDERS.

In an article in the "Iron Trade Review," Mr. Perrigo, in the course of an article on the "Management of Engineering Works," describes a board which is intended to be fixed on the wall of the superintendent's public office, and which, by the introducing and changing of small plugs, may represent in a graphic manner the progress of the work in the shops. This board is 37 in. wide and 27 in. high, and aside from the headings, etc., is ruled in 1-in. squares by white lines on the black surface of the board. The design is shown in the diagram. In the centre of each square is a $\frac{3}{8}$-in. hole. At the left are lettered the headings similar to those given. At the right is formed pockets in which may be placed small cards giving the months. These are used where orders run from one month into another, and so on. Over the squares are figures for days of the month. Fitted to the holes is a series of wood or metal plugs, upon the $\frac{5}{8}$-in. circular face of which may be gummed discs of white paper bearing the numbers of the orders in the works. These plugs are moved daily from one hole to another as the work advances. Should it be desirable to leave a continuous record of the day of the month on which an order arrived at each stage of progress, or passed through a certain department, there should be four or more series of holes for each day of the month, and a sufficient number of plugs with the order number indicated upon them to leave in the several holes as the work advances. The system is very useful for regular orders for lots of machines in which the assembled portions are carried along together. A similar board may be used for tracing the progress of special orders. It will be the duty of the cost clerk to make regular daily rounds of the shops, preferably in the forenoon, and note down in a small book carried for that purpose the facts necessary to make the change on the board, and on his return to the office to change the plugs to represent the progress of the work. The writer saw this plan used in a plant that included a number of buildings, some of them at quite a distance from the superintendent's office, and realised what a saving of time and annoyance it was, and how many necessary questions it answered during the day.



KEEPING ACCOUNT OF THE PROGRESS OF ORDERS.

F. REDDAWAY & COMPANY, LIMITED, of Pendleton, Manchester, have purchased the business of the Lancashire Patent Belting & Hose Company, Limited.

MESSRS. J. WILLIAMS & SONS, Globe Foundry, East Moors, Cardiff, recently secured an order for 1,500 tons of castings for one of the London tube railways

MOULD DRYERS.

To the Editor of the FOUNDRY TRADE JOURNAL.

SIR,—I was very much interested upon reading the article in the March number of your always welcome Journal on "Mould Drying Method for Steel Castings," but was surprised that the method of simply burning a gas flame in the mould was claimed to be an up-to-date system. For the purpose of letting your readers know there is, and has been, successfully used in this country for some years a more economical method, I am sending herewith a description of my mould dryer, from which you will note the advantage of using a large volume of high temperature air and gases generated in a specially constructed apparatus, and circulated rapidly through the mould, thereby driving out the moisture and considerably hastening the operation of drying.

Yours, etc.,

W. LITTLETON.

9, Fenchurch Street, E.C.

[From the circular sent by Mr. Littleton we hope to prepare a description of his mould dryer for a future issue.—ED. F.T.J.]

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STEELE-HARVEY MELTING FURNACE.

To the Editor of the FOUNDRY TRADE JOURNAL.

SIR,—With regard to the article which lately appeared in your Journal on the subject of the Steele-Harvey Furnace, in which you mentioned that we were putting down the first one in this country, we think it may interest your readers to know something about our experience in the working of it. At first, of course, we had some difficulty in getting the right class of oil; after a few trials, however, we got the furnace working satisfactorily, and as the result we consider it fulfills what is claimed for it by Messrs. J. W. Jackman & Company, Limited.

The furnace we have put down is for 375 lbs. crucible, and up to the time of writing the work done by this furnace is more than equal to that done by four coke furnaces previously used with 100-lb. crucibles. This means to us a reduction in the cost of melting and labour of more than 50 per cent., besides which the work done in this branch, instead of being finished as before at 6 o'clock, is now finished about 4 o'clock in the afternoon; this means a far greater output if we are working at full pressure.

The quality of the metal, which is a very special feature of our trade, is most satisfactory, being far purer than we have ever been able to get it with the ordinary coke furnaces.

With regard to other advantages, the following are the most conspicuous:—

No waste of metal, no ashes, very little attention when the furnace is once started. This liberates the furnaceman to help at other things. There are little or no fumes, which shows that there is complete combustion in the furnace, and there is a very great saving in crucibles. We have just taken out a 375-lb. crucible, which has stood 61 heats, and melted over 9 tons of metal.

With regard to the oil, we anticipate no difficulty in getting a proper supply at a low price, as our present oil merchants are prepared to contract for a supply in 10-ton lots at 2d. per gallon.

We have been paying up to now 2½d. per gallon for small quantities, and when we put down two more of these furnaces, which we certainly shall do shortly, we shall still further reduce our cost.

We have had many firms applying to us for our experience with this furnace, and, therefore, think that if you publish this letter it will give this the prominence which it rightly deserves.

Yours faithfully,

JONAS WELLS.

Keighley, March 23, 1905.

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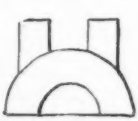
CASTING CORLISS CYLINDERS.

To the Editor of the FOUNDRY TRADE JOURNAL.

SIR,—Having read the letter in your March issue *re* the above, I may say that I have had considerable practical experience on such cylinders up to 100 h.p. in dry sand. The pattern was an ordinary split one, half in top and half in bottom, and I cored them in halves, which I found



to be the most expeditious. Care should be taken to ensure the top and bottom cores matching correctly, especially the valves. I always cast them horizontally, run on

the top, in the centre on the deep side, with three wedge-shaped runners 6 in. apart, about ⅜ in. thick and 2 in. wide on the casting, and ⅝ in. thick and 3 in. wide at the place of ingress. Risers are placed on the flanges at both ends, as per sketch. The runner box should be about 9 in. deep, and the use of shutters over the places of ingress until the runner head is full of metal is essential. Moulds and cores should be thoroughly dry, the vents free, and good, bright metal used, and the result will leave nothing to be desired.

Yours faithfully.

CHAS. E. ALLEN.

Grantham, March 12, 1905.

To the Editor of the FOUNDRY TRADE JOURNAL.

SIR,—In reference to your subscriber's question on Corliss cylinders, I have a varied experience of cylinders, and I should say that casting horizontally would be most favourable for the ones you mention. As I have made similar to those you are enquiring about, and they have turned out very satisfactory and clean, I also mention that it would be advisable to use iron that has been through the furnace before.

Yours, etc.,

"A MOULDER."

Bridgwater, Somerset.

BLACKINGS.

BY J. A. PHILLIPS.

NOBODY likes to see castings turned out of the foundry rough and scabby, more especially after a great deal of time and care has been expended on the moulds; yet one does often see such castings that are otherwise good and sound except the skin, which is very rough, caused entirely by the blacking being inferior or by improper mixing.

Blackings are destined to play a very important part in the art of moulding, so that when one finds a really good blacking its value cannot be over-estimated. There are many makers of blacking, as of all other commodities used in the foundry, and we must all be guided in the choice of blacking, as well as other requirements, by experience gained in the past and by results obtained.

T. D. West, a great authority on all matters relating to the foundry, tells us in his valuable book, "American Foundry Practice," "That the best way to prove if a mould has been prepared properly is to cast it," and so with blacking.

A good blacking will strip from the casting and leave the skin beautifully smooth and blue. Castings with these characteristics are generally good, sound castings, but an inferior blacking will allow the molten metal to burn to it, so that the blacking and sand around adheres to the casting, thereby causing no end of extra work to the trimmers when cleaning the castings so as to make them passable; but with all this extra work the castings will never be as nice in appearance as one upon which the blacking has not burnt.

It is, indeed, a very gratifying sight to foundrymen (and to all concerned, for that matter) to see the sand and blacking peel from the casting easily, leaving very little for the trimmers to clean off.

In preparing loam work for blacking, the skin or glaze of the mould or cores should always be rubbed off with glass-paper; then, when the blacking is applied, it will soak into the surface of the mould or core and become part of it. Should the blacking be put on this glaze it invariably washes off as soon as the molten metal comes in contact with it, the pieces washed off float about in the metal until they become imprisoned in some obscure part of the casting, or else they show through the skin. But in each case where this slight scabbing takes place it is certain that the casting is defective somewhere, although it may not be discernable. In some instances castings are condemned in consequence of these defects showing.

As regards mixing of blackings, so far as the author's experience goes, the best results have been obtained by mixing two parts of charcoal blacking with one part of carbon blacking, and a quarter part of plumbago with sufficient water. Then let the whole stand for twenty-four hours or thereabouts; by this means the mixture becomes thoroughly incorporated. For heavy castings a little clay-wash improves the mixture, but for general work water will do. Of course, good blacking can be rendered useless by senseless handling, but bad blacking can never be made useful by any amount of intelligent manipulation.

SIR W. G. ARMSTRONG, WHITWORTH & COMPANY, LIMITED, have lately turned out a quantity of cast and shear steel to the order of the East Indian Railway Company.

ALLOYS.

In view of the diverse formulæ given by different authorities for many alloys, the following list, which gives the usual composition of a few important alloys used in commerce, and also the composition of certain eutectics, may be of interest to your readers. The figures given are from analyses made by Mr. L. Parry, of Huddersfield. Mr. Parry uses the chemical formula for the metals, which are as follows:—Sn, tin; Pb, lead; Sb, antimony; Cu, copper; As, arsenic; Ni, nickel. M.Pt. means melting point:—

(1.) Eutectic alloy of tin and lead—Sn 60, Pb 40, M.Pt. 173 degrees C.

(2.) Eutectic alloy of tin, lead, and antimony—Sn 55, Sb 3½, Pb 41½, M.Pt. 177 degrees C.

(3.) Eutectic alloy of lead and antimony—Sb 11½, Pb 88½, M.Pt. 236.5 degrees C.

(4.) Tinman's solder (usually given as 50/50 metal)—Sn 46, Sb 3, Pb 51.

(5.) Plumber's solder (usually given as 1 : 2 metal)—Sn 30½, Sb, 2, Pb 67½.

(6.) Terne metal (usually given as 20/80 metal)—Sn 18½, Sb 1¼, Pb 80¼.

(7.) Accumulator metal (usually given as 10/90 metal)—Sn 9¼, Sb ¾, Pb 90.

(8.) Capsule metal—Sn 8, Pb 92.

(9.) Tea lead—1 to 3 per cent. tin.

(10.) Metallic packing (a common variety)—tin 4¾ per cent., lead 95¼ per cent.

(11.) Stereotype metal—Sb 14 to 20 per cent., tin 5 to 0 per cent., remainder lead.

(12.) Linotype metal—Sb 12 to 15 per cent., tin 3 to 1 per cent., remainder lead.

(13.) Ordinary type metal—Sb 20 to 25 per cent., Sn 2 to 7 per cent., remainder lead, with often ½ per cent. to ¾ per cent. each of Cu and As as impurities.

(14.) Magnolia and many other bearing metals—Sb 15, Sn 5, Pb 80.

(15.) Original babbit metal—Sn 89, Sb 7.3, Cu 3.7.

(16.) Casings of magazine rifle bullets—Cu 80, Ni 20.

It will be observed that in 2, 4, 5, and 6 the ratio of tin to antimony is about the same.

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For the prevention of corrosion in iron and steel a composition called Firsoline has been patented. This preparation is manufactured by the Firsoline Manufacturing Company, of High Street East, Newcastle-on-Tyne.

CUPOLA FAN PRACTICE.

In a paper by Mr. W. H. Carrier, read at a meeting of the American Foundrymen's Association, the author considers at some length the operation of centrifugal blowers for cupola service, including the air supply required per pound of coke used and per ton of iron produced; the relation of pressure, size of cupola and speed of melting; the horse-power required for various sizes of cupolas at different pressures, corresponding to different ratios of melting; the relation of speed, pressure and capacity of centrifugal cupola blowers; the effect of piping resistance upon the pressure and horse-power. The author concludes as follows:

"The horse-power required to operate a cupola at any stated pressure is to an extent independent of the size of the blower, so long as it has sufficient capacity to supply the required amount of air.

"The melting capacity of a cupola under standard conditions varies with the pressure according to fixed laws.

"More horse-power is required per ton of iron melted at the higher pressures than at the lower ones.

"At a fixed speed the greatest horse-power is taken when the blower is running wide open, or at free delivery; the least horse-power is taken when the outlet is closed. The increase in horse-power is proportional to the increase in air delivery.

"The piping resistance decreases the air delivery and decreases the horse-power at a fixed speed, but increases the horse-power when the fan is speeded up to give the same pressure at the cupola.

"The centrifugal blower presents some advantages over the positive blower, from the fact that better results can be secured at lower pressures, but there is a greater uniformity of blast pressure, and it offers a flexibility in regulation. With the exception of the belting, there is but little wear or deterioration; it will give as high efficiency after running 20 years as when first installed. On the other hand, the positive blower, owing to the friction of the contact surfaces, wears and deteriorates rapidly, and its effect, while high at the beginning, decreases rapidly, owing to the leakage caused by the wearing away of the contact parts."

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The agreement entered into between the Wilsons & Union Tube Company, Limited, and Stewarts & Lloyds, Limited, has been terminated, owing to a difference of opinion having arisen on the question of depreciation.

THE PATENT LAW.

An exhaustive paper on the above subject was read recently by Mr. C. Denton Abel before the Society of Arts, and we recapitulate shortly the main points which the author endeavours to bring out in his paper.

First, that the system of examination with power given to the examiners to refuse the grant of a patent on the ground of alleged want of novelty as carried out by the German and United States Patent Offices and those of many other countries, is detrimental alike to the interests of the inventor and to those of the State; that even admitting the system to be correct in theory, it is not practically possible to carry it out in such a manner as to be perfectly equitable to the inventor whilst safeguarding the interests of the community; that to attempt to carry out the system with the very inadequate staff at the command of the Patent Offices of those States constitutes a great injustice to the inventors.

Secondly, that it is an injustice to the inventor to oblige him to go to the expense of an appeal from the decision of a primary examiner; that when the views of the examiner differ from those of the inventor it should be the duty of the former to lay the matter before the higher authorities, and only if these confirm his decision should the inventor be called upon to argue the case further. This is the system provided for by the new rules of our Patent Office.

Thirdly, that the correct system of examination is that about to be adopted by the English Patent Office under the Act of 1902, always provided that an adequate examining staff be appointed and that such special arrangements be established for enabling the work of searching to be carried out in a perfectly efficient manner, so that the inventor shall not be put to unnecessary trouble in having to prove the novelty of his invention.

Lastly, that the Patent Office, instead of being as it now is, a mere branch of a second-rate Government Department, should be elevated to the position of an independent Government Department, directly responsible to the Cabinet and Parliament, as constituting the worthy representative of one of the main sources of England's greatness and prosperity.

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Steel, Peach & Tozer, Limited, have contracted to supply the Belgian State Railway with ten locomotive crank axles.

TRADE TALK.

Buck & Hickman, Limited, have opened an office at Guardian Buildings, 3, Cross Street, Manchester.

Messrs. Johnson & Phillips are supplying two direct-current dynamos for the Sheerness Dockyard.

The Horsley Company, Limited, are supplying the Burma Railways Company with steel water tanks.

Julian Kennedy, Sahlin & Company, Limited, have opened a branch office in Paris at 58, Rue de l'Arcade.

The rumoured Armstrong-Westinghouse amalgamation has been officially denied by both the companies concerned.

The Glengarnock Iron and Steel Company, Limited, have withdrawn from the Scotch Steel Trade Combination.

The fitting-out dock at Messrs. Beardmore & Company's new shipbuilding yard at Dalmuir is now sufficiently deep to berth a warship.

The Holwell Iron Company, Limited, of Asfordby, Melton Mowbray, are supplying cast-iron pipes to the Metropolitan Water Board.

Bolckow, Vaughan & Company, Limited, have received an order for 20,000 tons of steel rails for the James's Bay Railway.

Messrs. R. W. Blackwell & Company, of London, are supplying overhead equipment for the Stockport tramways for the sum of £4,343.

The Patent Axle-box & Foundry Company, Limited, have taken possession of their new works at Wednesfield, near Wolverhampton.

Mr. A. Campion has started in business at 144, Wellington Street, Glasgow, as an analytical and consulting chemist and metallurgical specialist.

Iron and steel manufactured by Messrs. Whitehead & Company, of the Deighton Iron Works, Tredegar, have been placed on the Government lists.

Two new bays have lately been built at the works of the British Electric Transformer Company, Limited, and fitted with the necessary machinery.

Messrs. Lassen & Hjort have appointed Messrs. Swallow & Gray, of 18, Grainger Street West, Newcastle-on-Tyne, as their Newcastle agents.

The Harris Patent Feed-Water Filter Company, Limited, have removed their London office and laboratory to 82, Victoria Street, Westminster.

GRAHAM, MORTON & COMPANY, LIMITED, are supplying and erecting at the Canon's Marsh Gas Works, Bristol, the complete ironwork for a new retort bench.

THE WELLINGTON FOUNDRY, Dudley, belonging to S. F. Turner, Limited, was the scene of a serious fire recently, which did damage to the extent of about £1,000.

MESSRS. COWANS, SHELDON & COMPANY, of Carlisle, have recently completed the construction of a large crane to be used in extending the harbour at Capetown.

T. & I. BRADLEY, LIMITED, Caponfield, Furnaces, Bilston, will, early next month, blow in a furnace having an estimated output of from 600 to 700 tons per week.

MR. W. H. BARNETT, of 60, Mark Lane, E.C., the London agent of Alfred Hickman, Limited, has put down new machinery for the manufacture of blacking for foundry purposes.

SIR ALFRED JONES has offered to take engineering students at the Liverpool University free trips on the Elder, Dempster steamers in order that they may acquire practical experience in the engine-room.

THE VICTORIA IRON AND STEEL COMPANY has been registered as a limited concern with a capital of £40,000, in £1 shares. The registered office of the company is at the Victoria Iron Works, Calder, Coatbridge.

THOMAS BUTLIN & COMPANY, LIMITED, of the Irthlingborough Iron Works, entertained their day employés at dinner at Wellingborough on Thursday, March 19. The chair was occupied by Mr. F. J. Butlin.

THE VULCAN BOILER & GENERAL INSURANCE COMPANY, LIMITED, have arranged with the authorities of the Manchester University for the establishment of a Fellowship for study and research in engineering.

CONSIDERABLE additions were made during last year to the system of electric power in use at the Clutha Works, Glasgow, of P. & W. Maclellan, Limited. The major part of the machinery is now electrically driven.

OBITUARY.

MR. JAMES MITCHELL, of the Woodside Iron Works, Coatbridge.

MR. J. RUSSEL, of Swindell & Company, of Withymoor Iron Works, near Dudley.

MR. E. BEMROSE, who retired from business in the iron trade of Derby many years ago.

MR. R. SPENCER, J.P., East Lancashire agent for the Wigan Coal and Iron Company.

MR. T. BROGDEN, of the firm of Messrs. Appleby & Brogden, ironfounders, of Scarbrough.

MR. W. H. DAWSON, head of the old-established works known as the Ashfield Foundry, Otley.

MR. J. STONES, of Messrs. Stones Brothers, bolt and nut manufacturers, Vulcan Works, West Bromwich.

MR. CONNEL, of Burntisland, Scotland, and chairman and managing director of the Lochgelly Coal and Iron Company.

MR. W. HATTON, father of Mr. G. Hatton, managing director of the Earl of Dudley's Round Oak Iron and Steel Works, Brierley Hill.

MR. R. S. SCOTT, the well-known engineer, chairman of the Leeds Forge Company, President of the Engineers' Federation of Great Britain, and a member of Scott & Company, shipbuilders.

MR. H. G. SPENCE, of the firm of Messrs. Richardson, Duck & Company, shipbuilders, Thornaby, and until recently chairman of the Tees and Hartlepool Shipbuilders' Association, and President of the Shipbuilding Employers' Federation.

COMPANY NEWS.

PEARSON & KNOWLES, LIMITED.—Ordinary dividend, 3 per cent.

VICKERS, SONS & MAXIM, LIMITED.—Dividend, 5 per cent. on ordinary shares.

HARVEY UNITED STEEL COMPANY, LIMITED.—Ordinary dividend, 7½ per cent.

THE BURNLEY IRON WORKS COMPANY, LIMITED. Dividend of 5 per cent. for half year.

WILLIAM COOPER & GOODE, LIMITED.—No dividend on ordinary shares; net profit, £2,261 6s. 3d.

ROBEY & COMPANY, LIMITED.—Annual profit, £32,898; dividend, 5s. on the ordinary shares.

STEWARTS & LLOYDS, LIMITED.—Net profits, £142,960; dividend, 5½ per cent. on ordinary shares.

WILLIAM JESSOP & SONS, LIMITED.—Depreciation, £5,000; reserve, £2,500; final dividend, 4s. per share.

BROWETT, LINDLEY & COMPANY, LIMITED.—Annual loss of £14,850, increasing the debit balance to £18,848.

William Doxford & Sons, Limited.—Dividend, 5 per cent. on cumulative preference and ordinary shares.

Brown Bayley's Steel Works, Limited.—Dividend, 5 per cent.; reserve, £6,000; carried forward, £11,565 18s. 5d.

Armstrong, Whitworth & Company, Limited.—Interim dividend of 10 per cent. per annum on the ordinary shares.

Palmer's Shipbuilding and Iron Company, Limited.—Interim dividend of 5 per cent. per annum for the half-year.

Bell Brothers, Limited. — Profit, £68,579; dividend on ordinary shares, 3s. per share; carried forward, £6,016.

C. & W. Walker, Limited.—Half-yearly dividend of 10 per cent. per annum on ordinary shares, and bonus of 2s. each.

Sir William Arrol & Company, Limited.—Gross profits for year, £35,000; dividend, 10 per cent. on the ordinary shares.

Charles Clifford & Son, Limited.—Dividends, 6 per cent. on both preference and ordinary shares, leaving £520 to carry forward.

Wilsons and Union Tube Company, Limited.—Half-yearly preference dividend, and balance of £126 4s. 11d. carried forward.

Cammell, Laird & Company, Limited.—Net profit, £185,731; dividend of 5s. on ordinary shares, and 4s. 7½d. on (new) ordinary shares.

Rivet, Bolt & Nut Company, Limited.—Profit, £42,539 4s. 11d.; depreciation, £11,314 8s.; dividend, 5 per cent. on ordinary shares.

Muntz's Metal Company, Limited.—Annual profit, £7,015; dividend, 5 per cent. per annum for half-year on preference and ordinary shares.

Bow M'Lachlan & Company, Limited.—Net annual profit, £13,723; dividend, 10 per cent. on ordinary shares; reserve, £2,500; depreciation, £3,500.

Hadfield's Steel Foundry Company, Limited.—Ordinary dividend, 2s. per share, together with a bonus of 1s. 6d. per share; carried forward, £15,607 5s. 8d.

The Leeds Forge Company, Limited.—Reserve, £10,000; depreciation, £20,000; preference dividend, 7 per cent.; ordinary, 10 per cent.; bonus on ordinary, 2s. 6d. per share.

P. & W. Maclellan, Limited.—Depreciation, £2,500; reserve fund, £1,500; dividend on preference and ordinary shares, 6 per cent.; carried forward, £1,047 0s. 9d.

PERSONAL.

Mr. Andrew Carnegie has in hand a biography of James Watt.

The late Mr. A. Roberts, of the Tipton Blast Furnaces, left estate of the gross value of £45,430.

Professor J. O. Arnold has been awarded the Bessemer Gold Medal of the Iron and Steel Institute.

Mr. R. Armitage, of the Farnley Ironworks Company, has agreed to contest Central Leeds in the Liberal interest.

The late Mr. W. B. Myers-Beswick, of the Yorkshire Iron and Coal Company, Limited, left estate of the gross value of £25,594 6s. 11d.

Mr. J. S. Harmood Banner, who was recently returned to Parliament, is chairman of the Pearson & Knowles Coal and Iron Company, Limited.

Mr. F. Elgar has resigned the managing directorship of the Fairfield Shipbuilding and Engineering Company, Limited, and has been succeeded by Mr. A. Gracie.

Mr. H. Vickers has resigned his position as foundry manager to W. Jessop & Sons, Limited, Brightside Steel Works, Sheffield, having been with that firm for fifteen years.

Mr. A. M. Jack has been appointed managing director of Hadfield's Steel Foundry Company, Limited. Mr. W. H. Dixon, the secretary, and Mr. H. Cooper the engineer, have also been appointed directors.

—o—

MONTANA GOLD.

An alloy called "Montana-Gold" has been sold in the United States and Canada in the form of spoons and other flatware. In colour it somewhat resembles 14-carat gold, but is not better in this respect than ordinary "Gilding," which consists of 9 parts of copper and 1 part of spelter. The aluminium which the alloy contains does not appear to improve it to any extent. An analysis was made of a spoon which had been purchased, and the results are as follows :—

Copper	83.03 per cent.
Zinc	10.35 ,,
Aluminium	.55 ,,
Iron	.07 ,,
Lead	trace.

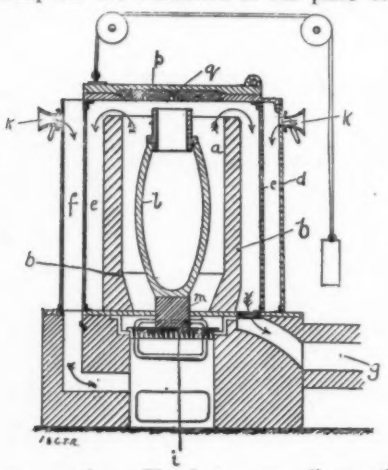
The spoon has the characteristic smell of brass, and the aluminium in it is only useful for advertising purposes. It was claimed, when the alloy was sold, that it was not brass.

NEW INVENTIONS.

List specially compiled for THE FOUNDRY TRADE JOURNAL by MR. GEORGE BARKER, Fellow of the Chartered Institute of Patent Agents, Consulting Engineer and Expert, 77, Colmore Row, BIRMINGHAM.
Telephone No. 1,300. Telegraphic Address—"PATENT, BIRMINGHAM."

22,546. 1903. L. HERTZOG, Arbon, Switzerland. Producing Heat from Gas Evolved from Solid Combustibles.

According to this invention the vertical shaft of a furnace in which the gases are developed is surrounded by an equidistant wall, which constitutes a chamber communicating at one end with the passage by which the hot gases leave the shaft, and at the other end with the piping, through which the cooled gases for consumption are conducted to the place of



consumption. The first surrounding wall is again surrounded by a second equidistant wall, whereby a second chamber is formed. One end of this chamber communicates through one or several openings with the atmosphere, and at the other end the second chamber may communicate through suitable channels with the ash-pit of the furnace; in case preliminary heated air is to be admitted to the fire. In the first chamber the hot gases are conducted longitudinally in a direction opposite to that of the hot gases in the shaft. The accompanying drawing, which is a copy of drawings attached to the inventor's specification, represents a crucible furnace in central vertical section. The wall *b* of the vertical furnace shaft *a*, is made of fire-clay and is adapted to receive the crucible *l* on the stone *m*, placed on the firegrate *i*; the shaft is also adapted to receive solid combustibles through the opening *p*, after the balanced cover *q* has been opened, the shaft being surrounded by the walls *c*, and whereby the first chamber *e* is formed between the walls *b* and *c*, and the second chamber *f* between the walls *c* and *d*. The gases developed in the shaft *a* go upwards, turn over the upper edge of the wall *b*, in the direction of the arrows, and pass down the chamber *e*. In passing through the first chamber the gases prevent the heat from radiating from the wall *b*, and return a great part of the heat to the combustibles within the shaft *a*, by transmission through the wall *b*. These gases also impart some of their heat to the wall *c*, to heat the air admitted from without, through the openings *k*, *k*, of the external wall *d*, and pass down the second chamber *f*. Thus the air is preliminarily heated before it passes through the channel *h*, into the ashpit and enters the shaft *a*. The air heated in the chambers *e* may be conducted through the channel *g*, and utilised, for instance, in radiators, or may escape into the atmosphere through a chimney.

QUERIES.

This department of the JOURNAL *undertakes the answering of queries in foundry practice and pattern making. We trust our readers will afford us assistance in answering these queries so far as possible.*

"FOUNDER," asks:—I shall be obliged if any of your readers will say what is the heaviest piece cast in the United Kingdom during the last 50 years, or so?

METAL FOR CASTINGS.—I shall be glad to know if you can give me the analysis of iron most suited to the following work:—C. I. fire bars; palisade; heavy and light machine castings; columns; test bars; and also for castings subjected to a severe shrinking strain.—F. M.

"ENQUIRER," asks:—(1) Will you kindly let me know through the columns of your valuable journal if it is the case that metal, *i.e.*, solid metal, will float in molten metal, and, if so, why? This question I have no doubt can be answered by many of your readers. (2) Is it the case that all fusible or liquified metals maintain in buoyancy their own solid bodies?

MR. S. E. SKELTON has been elected a director of Easterbrook, Allcard & Company, Limited.

ELDERS FOUNDRY COKE

As supplied to the British . . Admiralty Dockyards.

The following, selected from numerous letters, are eminent testimony as to the quality of our celebrated "A.A.A." Coppee Foundry Coke, carefully selected, and despatched in sheeted wagons.

From PECKETT & SONS, Bristol.

Bristol, October 25th, 1904.

We have been using your Selected Foundry Coke for some considerable time.

We have pleasure in stating that we are very pleased with it, as we find we get sounder and cleaner castings, more free from blow-holes and other defects, than we formerly did.

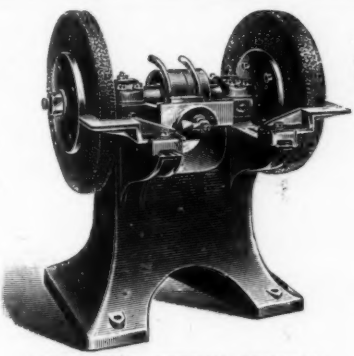
From MOUNTFORT PHILLIPS & Co., Llantrissant.

Llantrissant, October 25th, 1904.

In reference to the Foundry Coke you have been supplying us with for the last six months, we have very great pleasure in letting you know that it has given every satisfaction, and that our Works Manager and Workmen give it the highest praise.

Elders Navigation Collieries, LTD. Cardiff.

Nearly Fifty Years' EXPERIENCE in the Manufacture of Grinding Machines.



"CD" TYPE, MEDIUM GRINDER.

Machines complete with EMERY or CORUNDUM WHEELS, from £2 to £60.

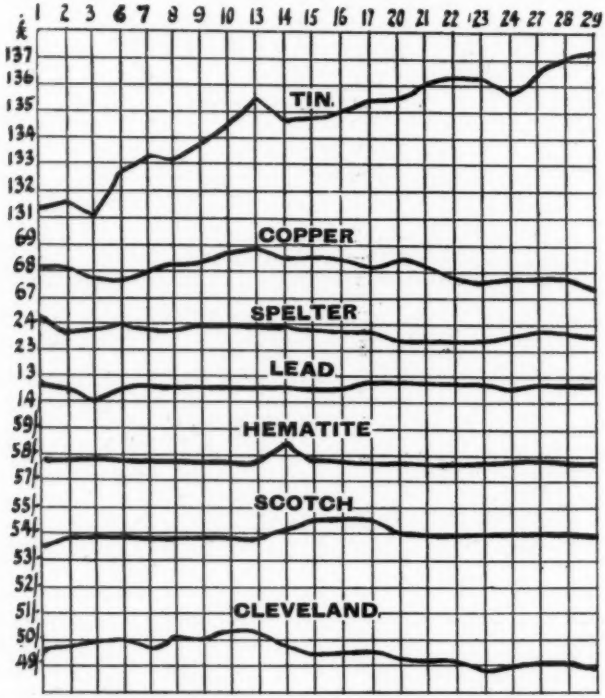
Mitchell's Emery Wheel Co.

MILL STREET, BRADFORD.

MANCHESTER.

Also at LONDON, GLASGOW, and BELFAST.

CHART SHOWING THE FLUCTUATIONS OF THE METAL MARKET IN MAR., 1905.



PRICES OF METALS.

The following table shows the approximate latest prices and position of stocks of metals during the past two years :—

Metals.	1904-5.	1903-4.
Iron—Scotch pig warrant ... ton	54/3	51/6
—Middlesbro' warrants ... ... ton	48/11½	43/10
—W.C. M/nos Bessemer ... ... ton	58/6	54/0
—Stock, Scotch, March 23. ...tons	15,600	8,650
Copper—Chili bars, GMB ... ... ton	£68 5/0	£57 12/6–£57 17/6
—Stock, Europe & afloat... ... tons	17,109	12,496
Tin—English ingots ton	£132	£129 10/0
—Straits ... ton	£131 7/6	£129 5 0
—Stock, Ldn. Hlnd and aflt ... tons	—	—
Lead—English pig ton	£12 10/0	£12 12/6
Spelter—Ord. Silesian ... ... ton	£23 12 6–£23 15	£22 3 9
Quicksilver-(75lb.) bottle	£7 12/6	£8 5
Antimony—Regulus ... ... ton	£38	£29 10

Castings.

In the Cleveland district the following are the nominal rates current for castings :—

	£ s. d.		£ s. d.
Columns (plain)	6 10 0	to	7 0 0
Pipes, 1½ to 2½ in.	5 0 0	to	5 5 0
,, 3 to 4 in....	4 12 6	to	4 17 6
,, 5 to 8 in.	4 10 0	to	4 12 6
,, 10 to 16 in....	4 10 0	to	4 12 6
,, 18 to 24 in....	4 10 0	to	4 12 6
Chairs	3 10 0	to	3 12 6
Floor plates (open sand)	3 0 0	to	3 2 6

Scrap.

The quotation for scrap subject to market fluctuations is as follows:—Engineers heavy scrap, 51s. to 52s. 6d.,; ditto light scrap, 20s. to 22s. 6d.; clean scrap brass, 38s.; clean scrap copper, 60s.; lead (usual draft), 11s.; tea lead, 10s.; zinc, 17s. 9d.; hollow pewter, 100s.; black pewter, 65s. per cwt.

CORE OVENS

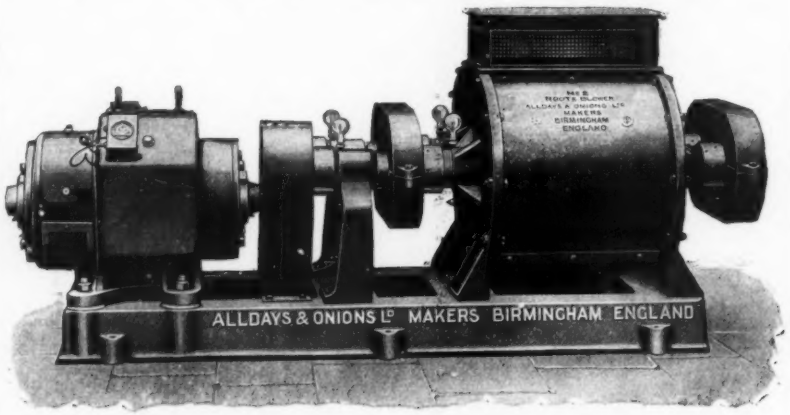
Everything for the Foundry.

JAMES EVANS & Co.,

FOUNDRY ENGINEERS,

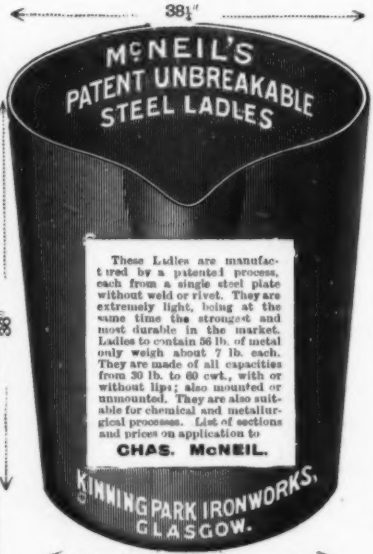
BRITANNIA WORKS, MANCHESTER.

ROOTS BLOWERS.



ALLDAYS & ONIONS PNEUMATIC ENGINEERING CO., LTD., BIRMINGHAM.

AND AT 20 BUCKLERSBURY, LONDON, E.C. Telegrams: "ALLDAYS, BIRMINGHAM."


38½"
McNEIL'S
PATENT UNBREAKABLE
STEEL LADLES
These Ladles are manufactured by a patented process, each from a single steel plate without weld or rivet. They are extremely light, being at the same time the strongest and most durable in the market. Ladles to contain 56 lb. of metal only weigh about 7 lb. each. They are made of all capacities from 30 lb. to 60 cwt., with or without lips; also mounted or unmounted. They are also suitable for chemical and metallurgical processes. List of sections and prices on application to
CHAS. McNEIL.
KINNING PARK IRONWORKS,
GLASGOW.
38"
32½"

Can also be made in Aluminium.

CHARLES D. PHILLIPS'

Registered and Improved

Foundry Core Oven,

Indispensable in any Foundry using small Cores.

Registered No. 356,812.

OVEN BUILT IN WALL

4 Shelves, each 10 inches deep. Sizes: Front width, 3 ft. 6 in.; height, 4 ft. 8 in. Inside, width, 3 ft.; depth, 2 ft. 7 in.; height, 4 ft. 3 in.

Price, £12 10 0

CHARLES D. PHILLIPS,

Emlyn Iron Works, NEWPORT (Mon.).

HUB IS NOT THROWN AWAY

when our

ECONOMY BRUSH

is worn out, because you can place fresh layers of Steel Wire on it yourself.

Used on Emery Grinders, they are found invaluable for

CLEANING CASTINGS.

Many other uses are always being found for them.

THE SPECIAL WIRE DOES NOT LAY DOWN OR BREAK OFF.

SIZES, 15 INCHES DIAMETER DOWN TO 8 INCHES.

J.W.&C.J.PHILLIPS,

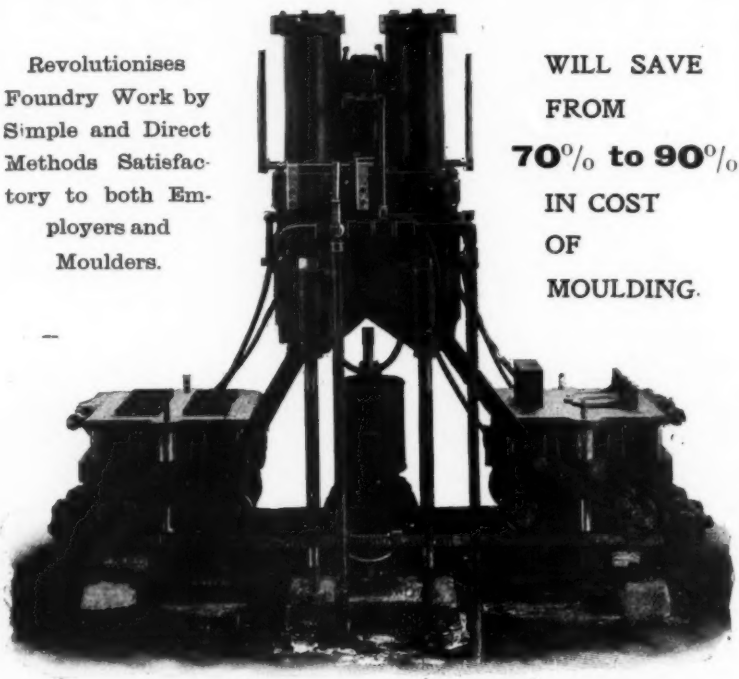
College Hill, London, Eng.

The McClelland Patent

SAND MOULDING MACHINE

Revolutionises Foundry Work by Simple and Direct Methods Satisfactory to both Employers and Moulders.

WILL SAVE FROM **70%** to **90%** IN COST OF MOULDING.



Type A.—Power Operated Carriage run under Rammer, Mould Rammed, Carriage Returned and Box Lifted, all Automatically. Arranged for one or two men to work continuously.

NO OTHER SAND MOULDING MACHINE HAS THE SPEED, SIMPLICITY AND STRENGTH OF THIS.

TURNS OUT BETTER MOULDS AND CASTINGS THAN BY HAND.

THE SAFETY TREAD SYNDICATE,

15, BARBICAN, LONDON, E.C.

Telephone, 5646 Bank. **Telegraph, "Unslipping," London.**

SITUATIONS VACANT AND WANTED.

TO BRASS MOULDERS.—Thoroughly good, reliable, and experienced practical Foundry expert is required to take charge of a large Brass Foundry, where nothing but the highest class of marine and hydraulic work, both large and small, is done in gun metal and high strength bronzes.—Applications (which will be treated in strictest confidence), stating age, experience, and salary required, to be addressed to Box 150, FOUNDRY TRADE JOURNAL, 165, Strand, London, W.C.

FOUNDRY FOREMAN seeks Engagement, 35; thoroughly practical and experienced in the production of all classes of work, in green, dry sand, and loom; non-society; energetic; good timekeeper and organiser; good references.—Address, Box 165, Offices of FOUNDRY TRADE JOURNAL, 165, Strand, W.C.

FOR SALE AND WANTED.

FOR SALE, "Roots" Patent No. 5 Pressure Blower (Nearly New), 14¾ in. outlet, outside bearing and driving pulleys, all self contained, on heavy foundation plate bed; for 6 or 7 tons per hour. Photo sent on application. Lloyds' Patent Fan (as New), 8 in. outlet, at half-price.—Address J. LIGHT, Wolverhampton.

FOR SALE.—The Patterns, Drawings, and Templets, with particulars of well-known and widely used Special Machinery, suitable for Heavy Foundry. Price £500 nett.—Apply "ENGINEER," care of THE FOUNDRY TRADE JOURNAL, 165, Strand, London, W.C.

FOUNDRY PLANT—The whole of the Plant of a Foundry at Pengam, working up to a recent date, for Sale; no reasonable offer refused.—THOMAS & EVANS, Porth.

FOR SALE, 20 in. Cappel Fan £20; two Farewell Moulding Machines £8 each, quite new; one Burns ditto £5; Piat's Patent Furnace and Cupola combined, used only dozen times, £20.—Apply GUEST'S, Iron-founders, Walsall.

FOR SALE, the Old-established Engineering and Iron Foundry of Holroyd, Horsfield, and Wilson, Ltd., Hunslet, Leeds; freehold about 8,000 yards.—Apply there.

FOR SALE AND WANTED.—*continued.*

CASTINGS.—For Good, Sound Machinery Castings, in Green or Dry Sand or Loam, up to 15 tons in weight, and Machined if required, apply to ROSE, DOWNS, AND THOMPSON, LTD., Old Foundry, Hull. Special Quotations for Quantities.

THE well-known FINE RED MOULDING SAND, for Iron, Brass, Aluminium, &c.—Apply MANSFIELD SAND CO., LTD, Mansfield, Notts.

CRUCIBLE STEEL CASTINGS for Collieries, Works, and Engineers, from customers' patterns; machined if desired.—P. T. WOODRUFF AND CO., Machen, Newport, Mon.

FIVE LATHES, length of beds 6 ft. to 27 ft.; Two Drilling Machines, One Planing Machine, One Shaping Machine, One Screwing Machine; Low Prices.—ATLANTIC WORKS COMPANY, Newport.

QUEEN VICTORIA STREET AND UPPER THAMES STREET (GARLICK HILL), close to the Mansion House Station, and in the centre of the Iron Trades, TO BE LET, a large BLOCK of WAREHOUSE PREMISES, with long frontage and a Floor Space of about 34,000 sq. ft. Steam and hand cranes. Rent £1,500 per annum, or in two portions.—Apply to Messrs. EDWIN FOX & BOUSFIELD, 99, Gresham Street, or DEBENHAM, TEWSOM & CO., 80, Cheapside, E.C.

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Will bring you a Specimen Copy of the
BRITISH MACHINERY GAZETTE
PUBLISHED MONTHLY.
And containing Offers of **10,000 LOTS** of New and Second-hand
MACHINERY OF ALL KINDS.
It will save you Time and Money.
BEANLAND, PERKIN & CO.,
North Eastern Works, LEEDS.

BLACK DELPH FIREBRICKS

For High Temperatures.

Also Special Grades for
CUPOLA LININGS, STEEL FURNACES,
BRASS FURNACES.

CRUCIBLE CLAYS.

E. J. & J. PEARSON, LTD.
STOURBRIDGE.

THE HELICAL CENTRIFUGAL PUMPS.

Wade and Cherry's Patent.

SOLE MANUFACTURERS AND PATENTEES, **John Cherry & Sons**

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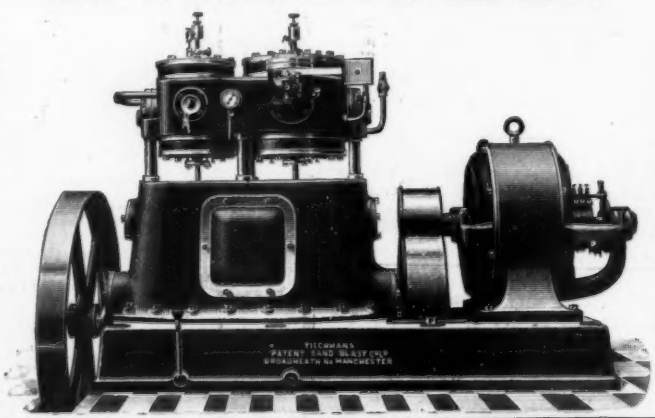
Tel. Address: "CHERRY, BEVERLEY."

Ganister, Cupola Blocks, Fire Bricks,
Fire Clay.
Silica Bricks, Tuyeres, Stoppers, Nozzles, &c.
Steel Moulders' Composition, Silica Cement.

J. GRAYSON LOWOOD & Co., Ltd.,
DEEPCAR, nr. SHEFFIELD.
Telegrams: "LOWOOD, DEEPCAR."

AIR COMPRESSORS
DRIVEN BY STEAM, BELT, OR ELECTRICITY.

HORIZONTAL & VERTICAL.
Single Stage & Compound Types.



High efficiency, Silent working and 12 months guarantee.

SAND BLAST APPARATUS for cleaning large & small Castings, either steel, iron or gun metal.

Tilghman's Patent Sand Blast Company, Ltd.,
BROADHEATH, near MANCHESTER.